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An Assessment of Air Force Data on Contract Expenditures

Lloyd Dixon, Chad Shirley, Laura H. Baldwin,
John A. Ausink, Nancy F. Campbell

Prepared for the United States Air Force

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PROJECT AIR FORCE

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Preface

For the past several years, the Air Force has been using data from the Individual Contracting Action Report form, also known as the DD350, to analyze its purchase of goods and services. These analyses support Air Force efforts to develop new purchasing and supply management strategies for important categories of goods and services. However, concerns have been raised about whether the DD350 data are accurate enough and detailed enough to conduct such spend analyses. To evaluate the suitability of these data for analyzing the purchase of goods and services, RAND Project AIR FORCE collected data to supplement information found in a sample of Air Force fiscal year 2002 (FY02) DD350 records. This monograph describes the survey and statistical methods used in this study as well as the researchers' assessment of the DD350 data, which is based on an extrapolation of the survey results to the entire Air Force FY02 database.

This research was part of a broader study, "Supporting Air Force Procurement Transformation and Laying the Groundwork for Services Acquisition Reform," sponsored by the Air Force Deputy Assistant Secretary for Contracting (SAF/AQC) and conducted within the Resource Management Program of RAND Project AIR FORCE.

This report is designed to assist Department of Defense personnel involved in conducting spend analyses and implementing commercial purchasing and supply management practices. As such, the authors assume that the reader has a basic understanding of commer-

cial purchasing and supply management practices, including the use of spend analyses to support the design of purchasing strategies.

For the past decade, RAND Project AIR FORCE has been helping the Air Force to reshape its sourcing policies and practices. Related RAND reports that may be of interest include the following:

- *Air Force Service Procurement: Approaches for Measurement and Management*, by Laura H. Baldwin, John A. Ausink, and Nancy Nicosia, MG-299-AF, 2005.
- *Air Force Procurement Workforce Transformation: Lessons from the Commercial Sector*, by John A. Ausink, Laura H. Baldwin, and Christopher Paul, MG-214-AF, 2004.
- *Organizational Concepts for Purchasing and Supply Management Implementation*, by Lynne M. Leftwich, James Leftwich, Nancy Y. Moore, and Charles Robert Roll, MG-116-AF, 2004.
- *Measuring Changes in Service Costs to Meet the Requirements of the 2002 National Defense Authorization Act*, by Chad Shirley, John A. Ausink, and Laura H. Baldwin, MR-1821-AF, 2004.
- *Defining Needs and Managing Performance of Installation Support Contracts: Perspectives from the Commercial Sector*, by Laura H. Baldwin and Sarah Hunter, MR-1812-AF, 2004.
- *Using a Spend Analysis to Help Identify Prospective Air Force Purchasing and Supply Management Initiatives: Summary of Selected Findings*, by Nancy Y. Moore, Cynthia Cook, Clifford Grammich, and Charles Lindenblatt, DB-434-AF, 2004.
- *Implementing Performance-Based Services Acquisition (PBSA): Perspectives from an Air Logistics Center and a Product Center*, by John A. Ausink, Laura H. Baldwin, Sarah Hunter, and Chad Shirley, DB-388-AF, 2002.
- *Implementing Best Purchasing and Supply Management Practices: Lessons from Innovative Commercial Firms*, by Nancy Y. Moore, Laura H. Baldwin, Frank A. Camm, and Cynthia R. Cook, DB-334-AF, 2002.
- *Federal Contract Bundling: A Framework for Making and Justifying Decisions for Purchased Services*, by Laura H. Baldwin, Frank A. Camm, and Nancy Y. Moore, MR-1224-AF, 2001.

- *Performance-Based Contracting in the Air Force: A Report on Experiences in the Field*, by John A. Ausink, Frank A. Camm, and Charles Cannon, DB-342-AF, 2001.
- *Strategic Sourcing: Measuring and Managing Performance*, by Laura H. Baldwin, Frank A. Camm, and Nancy Y. Moore, DB-287-AF, 2000.
- *Incentives to Undertake Sourcing Studies in the Air Force*, by Laura H. Baldwin, Frank A. Camm, Edward G. Keating, and Ellen M. Pint, DB-240-AF, 1998.
- *Strategic Sourcing: Theory and Evidence from Economics and Business Management*, by Ellen M. Pint and Laura H. Baldwin, MR-865-AF, 1997.

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Summary

More than a decade ago, commercial firms began to change the way they purchase goods and services to become more competitive in the marketplace. Through better management of their supply bases and supplier relationships and more sophisticated purchasing strategies, these firms have improved supplier performance and reduced the prices of their purchases for various categories of goods and services. A primary input to constructing the purchasing and supply-management strategies used by these firms is what is commonly called a “spend analysis” of a firm’s contract expenditures and supply base. This analysis can be used to identify potential targets of opportunity for change, which in turn enables firms to leverage their expenditures and design improved strategies for interacting with suppliers.

For several years, the Air Force has been working to incorporate widely accepted commercial purchasing and supply management practices into its purchases of equipment and supplies. These efforts are currently being expanded to include the purchase of services. To assist in these efforts, the Air Force Deputy Assistant Secretary for Contracting (SAF/AQC) asked RAND Project AIR FORCE to conduct an initial, high-level analysis of Air Force expenditures to determine how much the Air Force spends on different types of services.

The primary source of data on Air Force contract expenditures is the DD350 database. The DD350 database contains data from the Individual Contracting Action Report form (also known as the DD350 form). The DD350 database provides a good deal of information on contract transactions greater than \$25,000, but it was designed to support a variety of compliance-oriented analyses (e.g.,

analyses of purchases from small businesses or minority-owned businesses), rather than the types of detailed analyses of expenditures that are required for spend analyses.

In particular, the DD350 form does not allow for a detailed description of the various types of goods and services the Air Force purchases. The Product Service Codes (PSCs) used in the DD350 form to describe purchases are not detailed enough to capture the full range of goods and services purchased, and contracting officers are not trained in how to assign PSCs in a consistent way. Finally, many of the most important DD350 data fields from a spend analysis perspective are unaudited (i.e., they are not checked for completeness and accuracy).

Given these reasons for concern about the usefulness of the DD350 data for spend analyses, we undertook a formal assessment of the accuracy and completeness of key data fields that describe Air Force purchases. The possibility that purchases of services may be embedded in contract actions coded as purchases of goods (and vice versa) led us to examine data for both goods and services contracts.¹ We collected supplemental information on a sample of 306 contract actions from Air Force contracting officers. The sample was weighted more heavily toward larger-dollar-value contract actions because we hypothesized that those actions are more complex than lesser-value ones, and thus the information in the DD350 database on larger transactions may be less reliable than the information on smaller transactions.

To assess the accuracy and completeness of the information in the DD350 database, we interviewed the contracting officers responsible for entering the data on selected contract actions to learn more about the nature of each purchase. We then used statistical methods to extrapolate our findings from the sample to all contract actions in the Air Force fiscal year 2002 (FY02) DD350 database.

¹ A single contract between the Air Force and a supplier can have multiple contract actions associated with it. Such actions may represent incremental obligations of funds, deobligations, orders against indefinite delivery and indefinite quantity contracts, and other contract modifications.

Table S.1 summarizes our key findings on the accuracy and adequacy of Air Force FY02 DD350 data for spend analyses and our findings about the sufficiency of the current list of PSCs to describe Air Force purchases.

Although our analyses highlight serious problems with the DD350 data, we believe that the Air Force and the Department of Defense (DoD) could take steps over the short term and long term to improve the usefulness of these data for conducting spend analyses.

Over the short term, it would be helpful to communicate to the entire contracting workforce that these data now have an additional, important purpose—to aid in performing analyses to support implementation of new purchasing and supply management strategies. Our hope is that this message would encourage greater precision in describing the types of goods and services purchased. In addition, the Air Force could collect more detailed data to supplement DD350 data on contracts that fall within certain “problem” PSC areas that we identify in this report. With enough additional data, the Air Force may be able to use statistical analyses to develop guidelines for

Table S.1
Summary of Findings Regarding Accuracy and Adequacy of Air Force FY02 DD350 Data

Issue	Findings
Accuracy of the PSC coding in the DD350 forms (see pages 29–38)	The PSC for 50 percent of contract actions (39 percent of contract dollars) in the DD350 database is coded inaccurately. Services are undercounted.
Adequacy of using a single PSC to describe the contract action (see pages 38–44)	Eleven percent of contract actions (27 percent of contract dollars) include the purchase of more than one category of goods and/or services. Use of more than one PSC would allow for better description of 5 to 11 percent of contract dollars in the DD350 database.
How well the available PSCs describe Air Force purchases (see pages 22–26, 44)	Several important categories of activities are not fully captured in the current PSC codes. New PSCs could be used to better identify how at least 5 to 6 percent of contract dollars are spent.

adjusting the DD350 data to more accurately reflect the nature of the underlying purchases (see page 52).

Over the long term, the Air Force may be able to work with other branches of the military and federal agencies to refine the list of PSCs to include codes that better describe Air Force purchases, particularly for warranties on goods or services, special studies of Air Force operations or systems, and professional services. The Air Force may also want to consider recommending to the DoD that the DD350 form be modified to allow contracting officers to use more than one PSC to describe the goods and services purchased through contract actions (see page 52).

Based on our analyses, modifying the DD350 form to allow for additional PSCs and their corresponding dollar amounts would enable the Air Force to more accurately describe how 5 to 11 percent of DD350 contract dollars are spent, which translates to \$2 billion to \$5 billion worth of expenditures for FY02. However, before recommending that the DD350 form be modified to allow for multiple PSCs, the Air Force should evaluate the costs (e.g., the cost of making software changes, writing new manuals, conducting training on new systems, entering additional data in the form, and building a consensus for change within DoD) versus the benefits (i.e., the value added from improved purchasing strategies based on more accurate information on the full range of purchases) of such a change (see pages 52–53).

Finally, the Air Force may benefit from providing training in PSC coding to contracting officers, particularly those who work with technically complex contracts or contracts that include many different types of purchases (see page 53).

Acknowledgments

Many Air Force personnel provided valuable input and support for this research. First and foremost, we would like to thank the contracting officers who took the time to talk with us about their contract actions that were selected for the study. Because of assurances of anonymity, we are unable to list them by name, but we want them to know that their time was greatly appreciated. We would like to thank Col Robert Winiecki, formerly of SAF/AQCP, for asking us to undertake this work and for responding to contracting officers who had questions about our study. Captain Doug Thrailkill, formerly of AFLMA/LGC, helped us contact many of the contracting officers selected for this study. We also thank Capt Thrailkill and Ms. Becky Gebhard, AFMC/PKV, for their advice on conducting spend analyses using Air Force contracting data. Mr. Bob Hill, AFMC/PKS, and Mr. David Pfister, DISA, provided helpful information about the Air Force's DD350 database, which we used for this analysis.

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Finally, we are indebted to several of our RAND colleagues. Nancy Moore, Mary Chenoweth, and Judy Mele shared with us their expertise in conducting spend analyses using Air Force data. Mary Chenoweth and Edward Keating provided helpful comments on an earlier draft of this document, Mary DeBold assisted with preparing an earlier version of this document, and Nancy DelFavero did an excellent job of editing the final report.

Acronyms

ADP	automatic data processing
AFLMA/LGC	Air Force Logistics Management Agency/ Contracting
AFMC/PK	Air Force Materiel Command/Contracting
AFPEO/CM	Air Force Program Executive Officer for Combat and Mission Support
CLS	contractor logistics support
DFARS	Defense Federal Acquisition Regulation Supplement
DISA	Defense Information Systems Agency
DoD	Department of Defense
FY	fiscal year
GAO	U.S. General Accounting Office (now Govern- ment Accountability Office)
IDIQ	indefinite delivery and indefinite quantity (contracts)
NDAA	National Defense Authorization Act
PAF	RAND Project AIR FORCE
PSC	product/service code
R&D	research and development
RDT&E	research, development, test, and evaluation

SAF/AQC	Air Force Deputy Assistant Secretary for Contracting
TINA	Truth in Negotiation Act

Introduction

A robust and growing set of literature documents the evolution of purchasing and supply management practices within the private sector.¹ Firms are analyzing their corporate-wide expenditures and their supply base to (1) identify cost-saving opportunities, (2) develop improved purchasing strategies, and (3) better manage the supply base for important classes of goods and services. The goals of this sort of analysis are to increase performance of suppliers (e.g., to improve quality and to increase the frequency of on-time delivery) and reduce costs in order to extract greater value from the goods and services that firms purchase.

For several years, the Air Force has been working to incorporate well-regarded commercial purchasing and supply management practices for important categories of its equipment and supplies. RAND Project AIR FORCE helped initiate and is now supporting these efforts, particularly the Air Force Materiel Command's pilot projects for improving acquisition of spares and equipment within its Air Logistics Centers.²

Supplies and other goods are not the only targets of opportunity for the Department of Defense (DoD) to implement improved purchasing and supply management practices. According to previous

¹ See Moore et al. (2002) and Ausink et al. (2004) for discussions of this literature.

² Leftwich et al. (2004) and U.S. General Accounting Office (GAO; now the Government Accountability Office) (2003a).

studies,³ DoD spends more on services than on supplies and equipment. Its service expenditures have grown significantly since the early 1990s; those earlier studies show that in fiscal year (FY) 2002, the DoD spent about \$93 billion on services, which represents an increase of 18 percent from FY01. These purchases represent a broad range of service activities with varying degrees of complexity, including professional, administrative and management support; repair and maintenance of equipment and facilities; information technology support; medical services; transportation and travel; special technical studies; and support for system development and sustainment activities. As service expenditures have increased and surpassed other types of purchases, Congress has placed greater emphasis on lowering the cost and improving the performance outcomes of purchased services within the DoD.⁴

Using Spend Analyses to Improve Purchasing and Supply Management Practices

The first step toward implementing improvements in purchasing and supply management is to conduct what are called *spend analyses* to determine the nature of an organization's expenditures on goods and services and its supply base (i.e., the firms that sell goods and services to the organization).⁵ Initial aggregate-level analyses are used to help build the case for changing purchasing and supply management practices to better support corporate goals and to highlight potential targets of opportunity for further, more-detailed analyses. These more-

³ GAO (2003b, 2003a, 2002, and 2001); *The Next Steps in Services Acquisition Reform* . . . (2001).

⁴ The National Defense Authorization Act (NDAA) for Fiscal Year 2002 mandated implementation of improved management practices for DoD service acquisitions, and it established savings goals to be met over ten years. To motivate the use of new management practices, the FY03 version of the NDAA reduced the FY03 authorization for purchased services in DoD by \$600 million, with the Air Force's share of the reduction being \$183 million. See National Defense Authorization Act for Fiscal Year 2003 (2002).

⁵ Moore et al. (2002 and 2004); GAO (2003a).

detailed analyses are then used to develop improved purchasing strategies that are tailored to the characteristics of the products being purchased (including the products' supply chains and characteristics of the products' industries), the organization's demand for those products (e.g., the amount purchased, the range of internal customers, the variation in product specifications needed, the products' importance to core activities), and the organization's corporate objectives (e.g., making low-cost products versus maintaining a technological advantage). As spend analyses are repeated over time, they can also help an organization determine whether the introduction of new practices is achieving the desired results. An analysis conducted before such changes are introduced can serve as a baseline against which to compare analyses conducted after reforms are made.

For example, "rationalizing" the number of suppliers is an important part of many firms' long-term purchasing strategy.⁶ Rationalizing involves determining the "right" number of suppliers for a company and could include decreasing *or* increasing the number of suppliers that provide a given good or service. A company with too many suppliers for a given good or service may not have sufficient leverage over any individual supplier to reduce costs or increase performance.⁷ On the other hand, a company with too few suppliers of a particular good or service could be at risk of poor supplier performance if suppliers do not feel any competitive pressure to control costs, improve their products, or deliver on time. The "right" number of suppliers will depend on the importance of the good or service to the firm and the risks that are presented if the supply of the item is interrupted. A spend analysis to determine how many suppliers are being used and how much they are being paid is an important step in rationalizing the supply base.

The Air Force Deputy Assistant Secretary for Contracting (SAF/AQC) asked RAND Project AIR FORCE to conduct a spend

⁶ MacLean (2002).

⁷ A large supply base also makes it more difficult to form strategic supplier relationships and undertake supplier-development activities (e.g., improve supplier quality assurance procedures or implement cost-saving production techniques).

analysis of the Air Force's expenditures on purchased services to support its efforts in implementing proven commercial purchasing and supply management practices. To determine whether an accurate spend analysis could be conducted, we needed to learn more about the available data on Air Force contracts. As discussed in the next section of this chapter, questions about the reliability of Air Force contract data motivated the detailed analysis presented in this report. After we began our analysis of the contract database, the Office of the Secretary of Defense began its own DoD-wide spend analyses.⁸

The DD350 Form and Spend Analyses

The primary source of data for Air Force and DoD contract expenditures is the Individual Contracting Action Report form, also known as the DD350 (see Appendix A for the data fields in a DD350). A DD350 form is completed for each DoD contract transaction⁹ involving purchases in excess of \$25,000 and contains descriptive information about each purchase.¹⁰ DD350 forms are filled out by Air Force contracting officers, and all Air Force data on contract actions are submitted electronically to a central database through a reporting system called "J001."

The DD350 form and the data system into which the form is fed were not designed for the purpose of supporting spend analyses. Air Force documents state that the Executive Branch, Congress, the General Accounting Office (now called the Government Account-

⁸ GAO (2003b).

⁹ Contract transactions are hereafter referred to in this report as contract actions. A single contract between the Air Force and a supplier can have multiple contract actions associated with it. Such actions may represent incremental obligations of funds, deobligations, orders against indefinite delivery and indefinite quantity (IDIQ) contracts, and other contract modifications.

¹⁰ Use of the DD350 form is governed by Defense Federal Acquisition Regulation Supplement (DFARS) 204.670-2. Instructions for filling out the form are found in DFARS 253.204-70. Purchases for less than \$25,000 are typically recorded in a DD1057 form, although they may be recorded in the DD350 instead. In some special cases, actions greater than \$25,000 are recorded in the DD1057.

ability Office), and the Small Business Administration use the data to study DoD purchases from small or small and disadvantaged businesses, and to determine other information about competition for contracts.¹¹ As such, the DD350 data suffer from several limitations when viewed from a spend analysis perspective:

- The DD350 form allows only one principal product/service code (PSC) to be used to characterize each contract action. A contract action may contain multiple services and/or goods; therefore, the DD350 data may overstate or understate the types of goods or services actually purchased.
- The entire federal government uses the same set of PSCs to describe its purchases, so finding a code that precisely matches a good or service that is purchased solely by the military may be difficult.
- Interviews we conducted with Air Force personnel during the course of this study indicated that contracting officers receive little guidance on selecting an appropriate PSC; therefore, they use their own discretion when filling in the DD350 data fields. Because filling out the DD350 form is considered to be the final formality in completing a contract action, busy contracting officers may not spend a lot of time on this task.
- Interviews also suggested that the DD350 system is difficult to maneuver and sometimes rejects inputs that contracting officers feel are most appropriate due to internal consistency checks that are not transparent to users. With few formal audits of the accuracy of the DD350 data, it is reasonable to believe that information on a transaction recorded in the DD350 database may sometimes differ from the actual facts of the transaction.¹²

¹¹ U.S. Air Force Instruction 64-105 (2000).

¹² We did find documentation on one audit of DD350 data, which was conducted by the DoD Inspector General—Waivers of Requirement for Contractors to Provide Cost or Pricing Data, (2001). However, the report analyzed only one block of the DD350 form, which was related to the Truth in Negotiation Act (TINA).

Because of concerns that we, and other researchers, have had about potential inadequacies and inaccuracies in these data,¹³ we formally assessed the degree of confidence one should have in key data fields that describe Air Force purchases. Although our original focus was on expenditures for services, concerns about the accuracy of the data (in particular, the possibility that services are coded as goods or embedded in contracts for purchases of goods, for example) led us to broaden our analyses and examine data for both goods and services contracts. This report describes our research approach and methodology, as well as our findings on the adequacy and accuracy of Air Force DD350 data for conducting spend analyses.

Research Approach

DD350 forms correspond to *contract actions* rather than complete contracts; thus, our unit of analysis is the contract action. The number of Air Force contract actions recorded in the DD350 database is very large—more than 65,000 actions were recorded for FY02. We selected a moderately sized sample of 306 Air Force contract actions from FY02 and interviewed the contracting officers who (according to the data) had submitted the information. We took this approach in order to learn more about the nature of each contract action, including what was purchased, the dollar amount, and other relevant contract information. After analyzing the results from the interviews, we used a statistical approach to reweight our findings and extrapolate the results to the entire Air Force FY02 DD350 population. (Our methodology is described in detail in Chapter Two.) Our goals were to determine the *adequacy* of the DD350 data (i.e., how completely one PSC described what was purchased by a contract action) and the *accuracy* of the data (i.e., how closely what was recorded in the data

¹³ A 1999 study by Litton-TASC found that users were concerned about the integrity of the DD350 database. Users also found it difficult to correct errors made in the system (Litton-TASC, 1999). See also Moore et al. (2004) and GAO (2003a).

matched what we learned in interviewing the contracting officer responsible for the action).

Primary Findings

Our detailed findings, including a description of the potential causes of problems with the Air Force DD350 data, and suggestions for improving data collection are discussed in the following chapters. Here, we highlight our primary findings, extrapolated from our survey data for FY02.

- The PSC for 50 percent of contract actions (representing 39 percent of the total dollar value of the contract actions) is coded inaccurately; we estimate that services account for 66 percent of Air Force purchases, rather than 51 percent as indicated by the DD350 data.
- More than one distinct good and/or service was purchased in 11 percent of the contract actions (representing 27 percent of the dollar value of the contract actions in the DD350 database); 5 to 11 percent of the dollar value of all actions (roughly \$2 billion to \$5 billion) were associated with activities not described by the primary PSC (i.e., secondary activities).
- New PSCs could be introduced to better describe several types of common purchases; these purchases represent at least 5 to 6 percent of overall contract dollars.

Organization of This Report

Chapter Two describes our research methodology in detail. It includes a description of the DD350 form and our sampling methodology, problem areas uncovered during our survey, and a general discussion of the statistical methods used to extrapolate the survey results. Chapter Three presents the results of our analysis of the accuracy and adequacy of the Air Force FY02 DD350 data for conducting

spend analyses. Chapter Four summarizes our findings and includes recommendations for steps the Air Force might take in the short and long term to improve the usefulness of DD350 data for spend analyses.

Appendix A contains data fields from the DD350 form. Appendix B lists the PSC categories used in our analyses. Appendix C contains the survey questionnaire we used to gather information from Air Force contracting officers. Appendix D describes the contract actions included in the survey. Appendix E details the statistical approach we used to extrapolate the findings from our survey to all DD350 contract actions.

Research Methodology

Our analysis of the accuracy and adequacy of the Air Force FY02 DD350 database rests on an examination of a sample of contract actions from the DD350. In this chapter, we first describe how we selected this sample, the survey methods we used to collect additional information from the contracting officers responsible for supplying the data on the contract actions in our sample, and the survey response rate. We then describe some of the issues that arose in coding and interpreting the information provided by the contracting officers. We conclude by briefly discussing the statistical methods we used to extrapolate the findings from the sample to the Air Force FY02 contract actions in the DD350 database as a whole (which are discussed in more depth in Appendix E).

Overview of DD350 Database

The DD350 database is the primary source of information on the contracts the Air Force enters into when it purchases goods and services. A single contract between the Air Force and a supplier can have multiple contract actions associated with it. Actions may represent obligations under new contracts, additional funds to existing contracts, deobligations of funds, orders under indefinite delivery and indefinite quantity (IDIQ) contracts, and other contract modifications. The DD350 database provides information on virtually every DoD contract action involving a purchase worth more than \$25,000.

The contract actions in the DD350 database cover a substantial percentage of total Air Force purchases of goods and services and nearly all direct purchases from commercial firms. Moore et al. (2004) put total Air Force purchases for FY02 at \$69 billion. Approximately 28 percent of those purchases were made from other government agencies, leaving roughly \$50 billion in direct purchases from commercial firms. Moore et al. estimate that 96 percent of the direct commercial purchases are captured on DD350 forms.¹

The DD350 database provides a substantial amount of information on each contract action, including the following:

- dollar amount of the contract action
- limited description of what was purchased
- purchasing organization
- winning contractor
- date of funding or period of performance
- type of contract pricing (e.g., firm-fixed-price or cost-plus-incentive-fee)
- type of competition (e.g., full and open or set-aside)
- type of contractor (e.g., small disadvantaged business, woman-owned business, business owner of a particular ethnic group)
- contracting officer and his or her contact information.

The DD350 form describes what was purchased using a single PSC, which is a four-character hierarchical code. The general category of expenditures is described by the PSC's first character (which can be a letter or digit) and the remaining characters provide more details on what was purchased within the general category. According to the PSC documentation, PSCs that begin with a letter correspond to categories of services,² and PSCs that begin with a number corre-

¹ Contract actions for less than \$25,000 (captured in the DD1057 system) account for less than 1 percent of direct commercial purchases, and purchases using government purchase cards (credit cards) account for the remaining 3 percent.

² There is vigorous debate within the Air Force Materiel Command about what constitutes a service. For example, research and development (the PSC for which begins with the letter A)

spond to categories of goods (U.S. General Services Administration, 1998).³ Table 2.1 defines the first character of the PSCs that we used in our analysis. More details on PSCs are provided in Appendix B.

Tables 2.2 and 2.3 provide an overview of the number and dollar value of Air Force contract actions in the DD350 database for FY02. Approximately 65,500 Air Force contract actions, having a

Table 2.1
PSC Categories Used in the Analysis

First Character of PSC	Description of Goods or Services in the Category
Goods	
1	Weapons, ammunition, aircraft, space vehicles
2	Engines, turbines, ground vehicles
3 to 9	Other goods
Services	
A	Research and development (R&D)
B	Special studies and analyses (not R&D)
D	Automatic data processing and telecommunication services
J	Maintenance, repair, and rebuilding of equipment
K	Modification of equipment
L	Technical representative services
M	Operation of government-owned facility
N	Installation of equipment
R	Professional, administrative, and management support services
S	Utilities and housekeeping services
U	Education and training
Other letters	Other services

is not considered by some Air Force product center personnel to be a service, even though it is considered a service in the PSC classification system. Similarly, component-repair activities (the PSC for which begins with the letter J) are not considered to be services by some within the Air Force Air Logistics Centers. See Ausink et al. (2002) for additional discussion of these issues. We accept the PSC definitions of goods and services. Thus, we consider all activities that begin with a letter in the PSC system to be services and all those that begin with a number to be goods.

³ The PSC field for the contract actions in the completed DD350 forms we examined for this study was never blank, and PSC 9999 (for items that could not be classified using any other PSC) appeared on only a few actions.

Table 2.2
Distribution of Air Force Contract Actions in the DD350 Database for FY02, by First Character of the PSC and Dollar Value of the Contract Action

First Character of PSC and Type of Contract Action	Size of Contract Action							Total Number of Contract Actions	Share of All Contract Actions in DD350 Database (%)
	\$0–\$100K	\$100K– \$500K	\$500K– \$1M	\$1M– \$10M	\$10M– \$50M	\$50M– \$100M	> \$100M		
Goods									
1 Aircraft and components	1,366	1,245	382	803	140	17	20	3,973	6
2 Engines and components	659	559	225	354	37	2	1	1,837	3
Other goods	10,191	3,673	672	766	48	5	0	15,355	23
Total goods	12,216	5,477	1,279	1,923	225	24	21	21,165	32
Services									
A R&D	3,443	3,299	699	787	139	15	10	8,392	13
B Special studies, not R&D	334	297	94	97	5	1	0	828	1
D Automatic data processing and telecom services	1,186	818	221	175	6	0	0	2,406	4
J Maintenance and repair	2,146	1,505	352	407	19	0	0	4,429	7

Table 2.2—Continued

First Character of PSC and Type of Contract Action	Size of Contract Action							Total Number of Contract Actions	Share of All Contract Actions in DD350 Database (%)
	\$0–\$100K	\$100K– \$500K	\$500K– \$1M	\$1M– \$10M	\$10M– \$50M	\$50M– \$100M	> \$100M		
Services (continued)									
K Modification of equipment	128	185	54	91	6	0	0	464	1
L Technical representative services	125	157	41	48	12	2	2	387	1
M Operation of government-owned facility	238	273	55	87	9	2	0	664	1
R Support services	2,338	2,289	588	686	32	3	0	5,936	9
S Utilities and housekeeping	1,579	1,009	253	248	17	0	0	3,106	5
Other Services	11,598	4,546	869	670	34	3	1	17,721	27
Total Services	23,115	14,378	3,226	3,296	279	26	13	44,333	68
Total Goods and Services	35,331	19,855	4,505	5,219	504	50	34	65,498	100
Share of All Contract Actions in DD350 Database (%)	54	30	7	8	1	0.1	0.1	100	

NOTES: Some rows and columns do not sum exactly due to rounding. K = 1,000; M = 1,000,000.

Table 2.3
Value of Air Force Contract Actions in the DD350 Database for FY02 (\$millions), by First Character of the PSC and Dollar Value of the Contract Action

First Character of PSC and Type of Contract Action	Size of Contract Action							Total Value of Contract Actions	Share of Value of All Contract Actions in DD350 (%)
	\$0–\$100K	\$100K–\$500K	\$500K–\$1M	\$1M–\$10M	\$10M–\$50M	\$50M–\$100M	> \$100M		
Goods									
1 Aircraft and components	71	299	279	2,795	2,756	1,163	8,928	16,291	33
2 Engines and components	33	137	164	1,013	686	150	308	2,491	5
Other Goods	479	809	474	2,089	845	320	0	5,015	10
Total Goods	583	1,245	916	5,896	4,287	1,633	9,237	23,797	49
Services									
A R&D	208	849	508	2,376	2,855	947	2,060	9,803	20
B Special studies, not R&D	17	71	66	204	98	66	0	522	1
D Automatic data processing and telecom services	55	193	155	418	124	0	0	945	2
J Maintenance and repair	109	366	247	963	363	0	0	2,049	4
K Modification of equipment	8	51	39	239	116	0	0	453	1
L Technical representative services	6	38	29	150	235	150	389	997	2

Table 2.3—Continued

First Character of PSC and Type of Contract Action	Size of Contract Action							Total Value of Contract Actions	Share of Value of All Contract Actions in DD350 (%)
	\$0–\$100K	\$100K–\$500K	\$500K–\$1M	\$1M–\$10M	\$10M–\$50M	\$50M–\$100M	> \$100M		
Services (continued)									
M Operation of government-owned facility	13	66	40	275	202	114	0	710	1
R Support services	122	552	425	1,870	550	254	0	3,773	8
S Utilities and housekeeping	70	238	177	521	280	0	0	1,287	3
Other Services	390	1,089	617	1,648	585	173	115	4,617	9
Total Services	999	3,515	2,303	8,662	5,408	1,703	2,563	25,154	51
Total Goods and Services	1,582	4,759	3,220	14,559	9,695	3,336	11,800	48,951	100
Share of Value of All Contract Actions in DD350 Database (%)	3	10	7	30	20	7	24	100	

NOTES: Some rows and columns do not sum exactly due to rounding. K = 1,000; M = 1,000,000.

total purchase value of nearly \$49 billion, are in the DD350 database for FY02. The tables show the following:

- According to the PSCs, there are roughly twice as many contract actions for services as there are for goods, although goods and services each account for roughly one-half the total contract-action dollars.
- A high percentage (91 percent) of the contract actions are for less than \$1 million, but the dollar value of purchases is concentrated in contract actions for more than \$1 million. Contract actions exceeding \$1 million account for 9 percent of the contract actions but 80 percent of the contract-action dollars.
- Contract actions for services tend to be smaller than those for goods, with the result that more than 60 percent of contract actions are for services costing less than \$1 million. These contract actions account for less than 15 percent of total contract dollars.

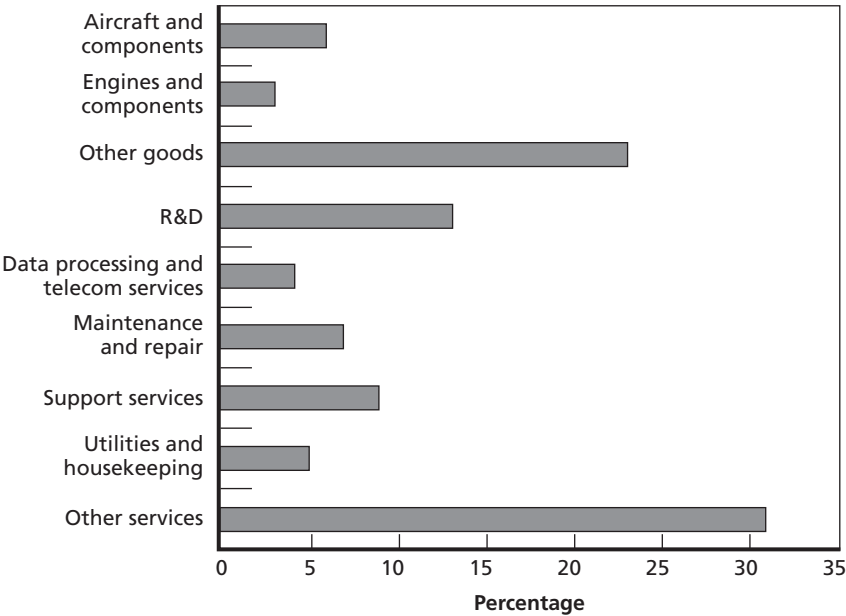
Figures 2.1 and 2.2 graphically illustrate the distribution of contract actions and contract-action dollars by PSC category.

Figure 2.3 plots the cumulative percentage of contract dollars against the cumulative percentage of contract actions. It clearly illustrates the concentration of purchase dollars within relatively few contract actions. For example, it shows that contract actions for \$10 million or more account for roughly 1 percent of all contract actions but approximately 50 percent of all contract dollars.

Sampling Methodology and Survey

We collected supplemental information on a sample of Air Force FY02 DD350 contract actions through a survey of Air Force contracting officers listed in the DD350 database as being responsible for

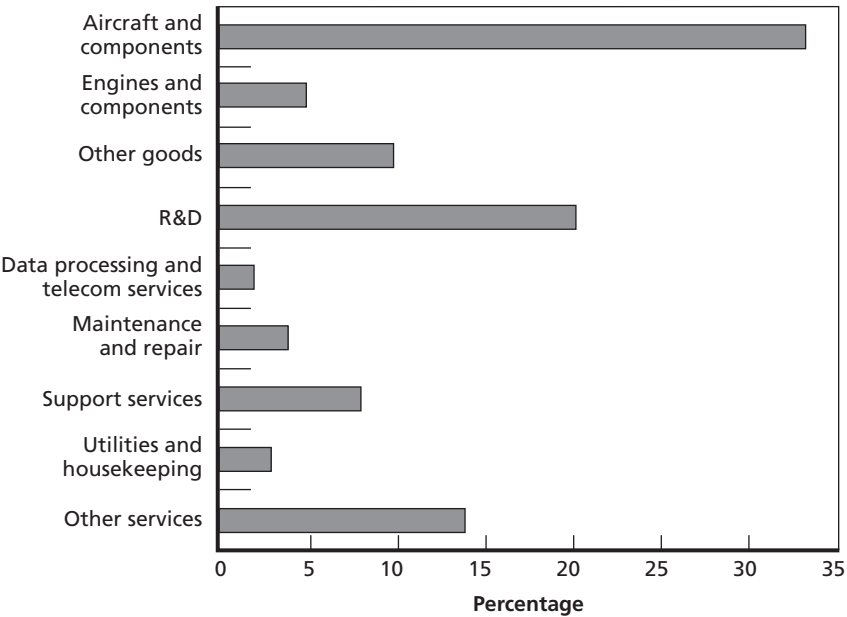
Figure 2.1
PSC Categories as a Percentage of Total Air Force FY02 DD350 Contract Actions



RAND MG274-2.1

those actions. Our approach to sample selection balanced limited project resources with the need for a sample that would provide as much information about the adequacy and accuracy of the DD350 data as possible. To this end, we weighted the sample toward contract actions with larger dollar values because they account for a disproportionately large share of overall contract expenditures, and because we suspected that these actions might contain multiple distinct activities. We conducted telephone interviews rather than use a written survey so that we could ask questions to more fully explore the nature of the contract actions. To reduce the cost of the telephone interviews, we constructed the sample so that we could collect information on more

Figure 2.2
PSC Categories as a Percentage of Total Air Force FY02 DD350 Contract Dollars

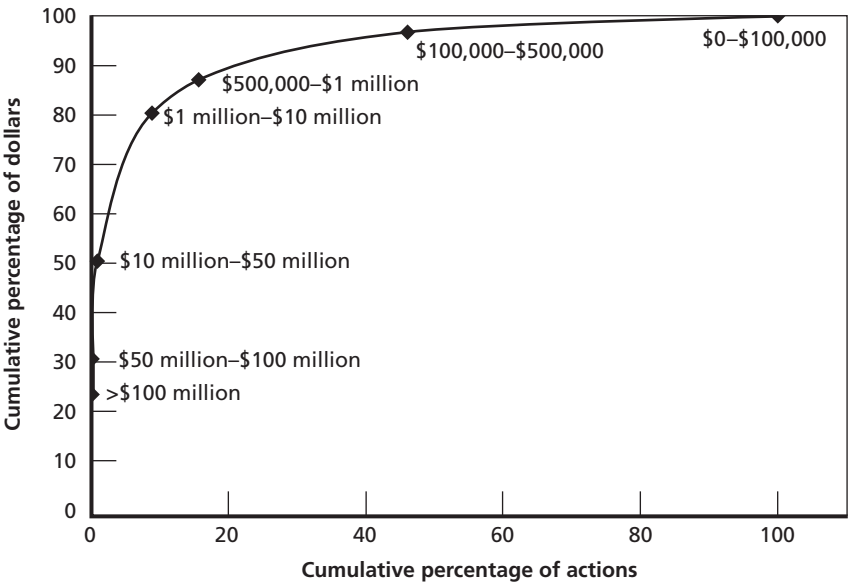


RAND MG274-2.2

than one contract action from each contracting officer we interviewed. In this section, we outline our process for selecting the sample and describe the survey.

Budget and time constraints limited our sample to approximately 300 Air Force contract actions from the FY02 DD350 database. As discussed earlier, roughly one-half of the expenditures were for contract actions that the PSCs indicated were services. This number might suggest that splitting the sample roughly evenly between goods and services would be appropriate. However, there were more than twice as many service actions in the DD350 as there were goods actions. Based on these considerations and our sponsor's particular interest in services, we selected approximately 225 service contract actions and 75 goods contract actions for the final sample.

Figure 2.3
Concentration of Air Force FY02 DD350 Contract Expenditures



RAND MG274-2.3

We used a two-stage process to select our final sample. The initial sample was randomly selected with sampling weights proportional to the dollar value of the contract actions (weights were calculated separately for goods and services).⁴ In the second stage, we selected contract actions from those identified in the first stage using the criteria discussed next.

Roughly 2,500 contracting officers are listed in the Air Force FY02 DD350 database. This means that contracting officers on average handle just over 25 contracting actions per year. In our initial sample, some contracting officers were associated with multiple con-

⁴ To make the selections using weights proportional to the dollar value, we multiplied the value of each contract action by a constant. We then assigned a random number between zero and one to each contract action and selected the contract action if the random number was less than the constant times the dollar amount of the action. The constant was adjusted until the desired number of contract actions was obtained. The same approach was used for the goods contract actions.

tract actions, and others were associated with only one. As stated earlier, to reduce the cost of conducting the interviews, we excluded contracting officers with only one action. To ensure that we had sufficient heterogeneity in our sample, we randomly selected two contract actions from those contracting officers who were responsible for three or more of the contract actions in the initial random sample. Because we wanted to make sure that the largest contract actions were included in the sample, however, we made some exceptions to this procedure. *All* goods contract actions for more than \$100 million were selected from the initial random sample, even if it meant that there was a contracting officer in the final sample with only one contract action. If a service contract action was greater than \$50 million, and the associated contracting officer had only one contract action, the action was still included in the final sample. This did not mean that all service actions greater than \$50 million in the initial sample were included in the final sample; some contracting officers in the initial sample were responsible for more than two \$50-million service actions, in which case only two of their contract actions were randomly selected.

In the end, 231 services contract actions and 75 goods contract actions were selected. The 231 actions amounted to 0.5 percent of the 44,333 services contract actions and 22 percent of the expenditures on services contract actions in the Air Force FY02 DD350 database. Although the sample of goods contract actions amounts to only 0.35 percent of the overall goods actions, it covers 42 percent of the dollars in the FY02 DD350 data.

Supplemental information on the actions in our final sample was collected through structured telephone interviews with the contracting officers listed for each action in the DD350 database. (See Appendix C for the interview protocol).⁵ Telephone interviews typically lasted approximately ten minutes per contract action, or 20 to

⁵ Initial contact was made with contracting officers by letter (via FedEx), e-mail, or telephone. The purpose of the study was described and the name of a contact at the organization sponsoring the study (SAF/AQC) was provided. When requested, a list of interview questions was provided to help the contracting officer prepare for the interview.

25 minutes per contracting officer. The interviews were conducted during February and March 2003.

As shown in Table 2.4, the response rate to the survey was high. Of the 306 contract actions selected, interviews were completed with the contracting officers responsible for 243 of them (79 percent). Very few contracting officers refused to participate in the study. We were unable to contact some of them, and some were unable to schedule interviews before the survey ended. The characteristics of the contract actions for which interviews were completed are summarized in Appendix D. Overall, expenditures on the 180 services contract actions for which we completed interviews totaled \$4.4 billion (17 percent of expenditures for all Air Force FY02 service contract actions in the DD350 database). Expenditures on the 63 goods contract actions for which we completed interviews totaled \$9.6 billion (40 percent of expenditures for all Air Force FY02 goods contract actions in the DD350 database).

Challenges in Assigning PSCs to Contract Actions

After interviewing each contracting officer, we assigned a PSC to the contract action for which the contracting officer was responsible

Table 2.4
Survey Completion Rate

	Number of Service Actions	Number of Goods Actions	Total
Contract actions selected from DD350 database	231	75	306
Contracting officer refused to participate	5	2	7
Unable to contact contracting officer or schedule an interview	46	10	56
Contract actions for which interview was completed	180	63	243
Completion rate	78%	84%	79%

based on his or her description of the goods and/or services purchased (these PSCs are referred to in this report as “RAND-assigned” PSCs).

We found this code-assignment process to be challenging because of limitations in the available PSCs and the complexity and range of activities that the Air Force purchases. In some cases, it appeared that no existing code accurately described an activity. In other cases, several different codes could arguably be applied to the same activity. To ensure consistency in the PSC assignments, four RAND researchers with previous Air Force contracting–related research experience conducted the interviews. The entire research team participated in an initial set of interviews to standardize the interview process and the coding of questionnaire responses—in particular, the assignment of PSCs to activities as they were described by contracting officers during the interviews. Subsequent interviews were conducted by individual team members, but weekly teleconferences were conducted to discuss progress and problems, and to ensure that all researchers were using the same rules to assign codes. The coding was most challenging when we found that the action included more than one service or good or a combination of goods and services. In some cases, follow-up conversations with contracting officers were necessary to ensure that we understood and captured all the important goods and/or services in an action. The challenges we faced and how we handled them in our analysis are described next.

Activities That Were Not Well Described by Existing PSC Codes

We had trouble identifying appropriately descriptive codes for two categories of activities: (1) studies performed as part of professional services, which, in our opinion, required more-descriptive codes to better capture the specific nature of the study being performed and (2) warranties, for which no PSC currently exists. In each of these cases, we created new codes for our analyses.

- **Studies.** In our analysis, we identified three major types of studies performed as part of professional services by contractors. In each case, the contracting officer had assigned a Professional Services PSC (starting with R4), perhaps because the Special Studies codes (starting with B) do not offer an appropriate alternative. To differentiate among them, we created a new code for each of the following types of studies:
 - Support for day-to-day analytic needs of program offices, e.g., administrative support for collection and organization of data for reports, assistance in preparing briefings, and so forth. We coded these activities using the existing four-digit codes that begin with R4.
 - Engineering studies to address a specific problem, e.g., how to address parts obsolescence (diminishing sources of supply) problems, the effects of corrosion on the structural integrity of an airframe, or the most effective repair for a new maintenance problem. We created two new codes for these activities: B560 for special studies for aircraft and B561 for special studies for space systems.
 - Engineering studies to support the design and/or installation of a modification. Because codes with the prefix K0 are used for modification services (for example, K010 is the code for the modification of weapons), we created a new code with the prefix K1 for studies that support such modifications. For example, for a study done in preparation for the modification of a weapon, the code would be K110.
- **Warranties associated with purchased parts or systems.** The closest general category for coding a warranty was Maintenance, Repair, and Rebuilding of Equipment (J), the type of activity that a warranty covers. We felt that it would be useful to distinguish spending on actual maintenance and repair activities from spending on what is in effect an insurance policy for problems with parts or systems; therefore, we created the code prefix J1 to represent warranties. As with the new K1 prefix, the third and

fourth digits of the PSC denote the item to which the warranty applies.

Activities for Which Several PSCs Might Be Applicable

We also encountered several types of activities that could be described by more than one PSC. The following list describes the activities in this category that we encountered most frequently, along with an explanation of our coding decision. It is likely that many other activities such as these were not captured in our sample.

- **On-site (e.g., at a depot) engineering support from a contractor.** Should this activity be considered a technical representative service (L) or some type of engineering support (R4)? In our analysis, we coded it as a technical representative service to differentiate it from the program office support discussed earlier.
- **Installation of a modification kit.** Should this activity be considered an installation service (N) or a modification service (K)? We coded it as a modification service to preserve the underlying intent of the activity.
- **Fleetwide replacement of a part (e.g., a vertical stabilizer) with a similar part made of different materials.** Should this activity be considered a repair activity (J), a modification activity (K), or a parts purchase (goods code)? In our analysis, we attempted to differentiate modifications from repairs based on whether the nature of the part that was replaced or the capabilities of the system changed as a result of the activity.
- **Prototypes for research, development, test, and evaluation (RDT&E).** Should prototypes be considered part of the RDT&E activity (A) or considered as goods? We considered prototypes to be part of the RDT&E if they were changing as the RDT&E progressed—i.e., if they were part of the RDT&E process.
- **Production follow-on to a contract that was originally for the purchase of RDT&E.** Should this activity continue to be coded as an RDT&E activity (A), or should it be switched to a produc-

tion activity (goods code)? For our analysis, we chose the latter option.

- **Contractor Logistics Support (CLS).** Should this activity be considered a maintenance/repair activity (a PSC starting with the letter J) or logistics support services (R706)? Because PSCs beginning with R are generally used for professional, administrative, and management support services, we reasoned that codes beginning with J were more descriptive of the maintenance and repair activities included in CLS.

Actions That Include Multiple Activities

As discussed in Chapter One, the DD350 form forces contracting officers to choose a single PSC for each contract action. For contracts containing multiple activities, it may be difficult to identify the single best PSC. In some cases, such as parts and services required for a repair, the multiple activities are closely affiliated. In other cases, such as the many activities required to maintain a facility, the activities are clearly distinct. Examples of both cases are listed next. In each instance, a single PSC cannot capture the additional activities being purchased.

Closely Affiliated Activities

- Modification kit purchase (goods code) plus a warranty for the kit (the J1 code prefix created for this analysis)
- Test equipment purchase (goods code) plus maintenance of the equipment (J)
- Repair activity (J) that includes contractor-provided replacement parts (goods code)
- Systems integration services to design the installation of a modification kit (the K1 code prefix created for this analysis), purchase of the kit (goods code), and installation of the kit (K0)
- Total system support that includes maintenance of an aircraft (J) and software (D), systems engineering services to support the program office (R4), and personnel training (U)

- Operation and maintenance of prepositioned supplies and facilities that include the lease or rental of facilities (X), facility maintenance (S), and maintenance of equipment (J).

Multiple Distinct Activities

- Several installation support services, e.g., housekeeping (S) and building maintenance (Z)
- Charter airlift for people (V221) and cargo (V121).

In our analysis, we allowed for as many PSCs as necessary to capture the range of purchased activities. We then identified the highest-dollar PSC as the primary PSC for the action.

Allocation of Expenditures to Multiple PSCs

One of the issues that arose in assigning multiple PSCs for a single contract action is how dollars should be allocated to those PSCs. During our interviews, we asked contracting officers for information on the dollar amounts associated with distinct activities; however, separate dollar amounts for those activities could not always be disentangled.

In such cases, we designated one PSC as the primary code for the action according to the likely size of its share of the obligation value. We then employed two alternative approaches to allocating dollars among the PSCs for the action. One approach allocated all dollars to the primary PSC in the action, reflecting the DD350's current mode of assignment. The second approach, covering the other extreme, spread the dollars evenly across all of the PSCs in the action. Generally speaking, the results were not significantly affected by which approach was used, in part because of the relative infrequency of multiple PSCs and in part because specific types of activities did not systematically qualify for the primary place within the action.

Extrapolating Results to the Entire DD350 Population

Because we focused on larger-dollar-value contract actions in our survey sample and because of the different sampling rates used for goods and services, our survey data do not accurately represent the characteristics of the entire population of Air Force FY02 DD350 actions. Therefore, we reweighted the survey results to accurately reflect the true mix of contract actions and dollars in the entire FY02 DD350 population before drawing conclusions about the accuracy and adequacy of these data. In the next chapter, we indicate when our findings are based on reweighted data and when they are based directly on survey data.

For the reweighting process, we first distinguished between contract actions classified in the DD350 as goods and those classified as services. We then identified seven different contract-action dollar-size categories. These categorizations gave us a total of 14 distinct action-type/dollar-size strata—seven for goods and seven for services. Weights were applied to each of the 14 strata as appropriate. Appendix E describes our reweighting methodology in greater detail.

Findings

In this chapter, we describe our findings on the accuracy of DD350 data (how closely what was recorded in the DD350 forms matched what we learned from talking to the contracting officers responsible for filling out the forms) and the adequacy of the data (how well one PSC described what was purchased) for conducting spend analyses. As discussed in the previous chapter, we reweighted the survey data to reflect the broader population of Air Force FY02 DD350 data.

Accuracy of the DD350 Data

DD350 data have several inherent limitations that might affect their accuracy. The current set of PSCs is meant to be used by all organizations in the federal government. To be general enough to serve this purpose, the PSCs may not be sufficient to fully characterize the range of services purchased by the Air Force and by the DoD more generally. Thus, as we discussed in Chapter Two, assigning an appropriate PSC can be difficult. In addition, because only one PSC can be assigned to an action, the *primary* activity in the contract must be chosen. This implies that spending on some categories of goods or services might be understated or overstated.

For example, consider two hypothetical contract actions used to purchase janitorial and food services—two services with different PSCs. Suppose the first action purchased \$10 of janitorial services and \$5 of food services (and would be reported as a \$15 “janitorial”

contract), while the second action purchased \$10 of janitorial services and \$15 of food services (and would be reported as a \$25 “food services” contract). The total spent on each of the two types of services is \$20, but the reported spending for janitorial services would be \$15 (an understatement), and the reported spending for food services would be \$25 (an overstatement). A similar problem exists with purchases of goods that might include services (such as warranties) or purchases of services that might include the purchase of a good. In either case, using only one PSC obscures information that helps to describe the purchase more accurately.

In addition to coding limitations, we were told during background interviews conducted during this study that although contracting officers receive training in how to complete and submit a DD350 form, they do not receive specific training in how to determine the appropriate PSC for an action, and they have considerable discretion in assigning codes. Standardization in coding therefore is limited, and this problem is complicated by the fact that there is very little auditing of how DD350 information is recorded.

Another problem that potentially affects the accuracy of DD350 information is that filling out the form is considered by contracting officers to be a final formality in completing a contract action. Many Air Force personnel we surveyed indicated that the DD350 system is difficult to maneuver. The best characterization of the purchased goods or services may not always satisfy system input requirements.

The difficulties with DD350 coding collectively underlie the results shown in Table 3.1. In our analysis, we define accuracy as a match between the first character of the PSC found in the DD350 record and the first character of the primary RAND-assigned PSC. (When we assigned multiple PSCs to a contract action, the primary RAND-assigned PSC is the PSC accounting for the most dollars.) Thus, we examined how accurately the DD350 is capturing the primary PSC. Under this generous definition of accuracy, our reweighted survey results indicate that 50 percent of the recorded Air Force FY02 DD350 actions are inaccurate in terms of their descrip-

tion of the purchased activities, and these inaccuracies represent 39 percent of the contract dollars.¹

Details of DD350 Coding Inaccuracies

To further explore the nature of DD350 PSC inaccuracies, we grouped contract actions into the categories shown in Figure 3.1. Actions for which the first character of the primary RAND-assigned PSC and first character of the DD350 PSC matched are represented by the black oval in the figure. If the two PSCs did not match at the first character, we next determined whether they were both of the same type (that is, either goods or services). The DD350 contract actions that we confirmed were accurately coded as a good or a service, through our interviews with contracting officers, are represented by the lighter-shaded oval in the figure. For the remaining actions, our PSC assignment differed from the type of PSC recorded in the DD350 database. Actions recorded in the DD350 as services that we determined through our interviews were best described as goods, or actions recorded as goods that we determined were best described as services, are represented by the two darker-shaded ovals in the figure.

Table 3.1
Estimated Accuracy of PSCs for Describing Air Force FY02 DD350 Contract Actions

	DD350 PSC Is Accurate ^a	DD350 PSC Is Not Accurate
Contract Actions	50%	50%
Dollars Represented by Contract Actions	61%	39%

NOTE: Percentages are based on survey data that has been reweighted to reflect all Air Force FY02 DD350 contract actions.

^a *Accurate* refers to a match between the first character of a DD350 PSC and the first character of a primary RAND-assigned PSC.

¹ The findings from our survey sample (see Chapter Two) have been extrapolated to the population of Air Force FY02 DD350 contract actions.

The figures and tables that follow use the framework in Figure 3.1 to examine the nature of the coding errors in the Air Force FY02 DD350 population that we identified through our interviews.

As shown in Table 3.1, we estimate that 39 percent of the contract dollars in the Air Force FY02 DD350 database have inaccurate PSC information. Figure 3.2 illustrates how this percentage is broken out: Of the 39 percent, 16 percent of the expenditures are for actions that are correctly coded as a good or service, but the first character of the primary RAND-assigned PSC corresponds to a different good or service than the one recorded in the DD350 form. The other 23 percent of these dollars is associated with actions that are miscoded as a good or service. Breaking down the 23 percent further, 18 percent is for goods that should have been coded as services, and the other 5 percent is for services that should have been coded as goods.

Contract Actions for Goods. Figure 3.3 shows how coding inaccuracies for actions recorded as goods in the DD350 database vary with the dollar value of the action.

Figure 3.1
Hierarchy of DD350 Coding Inaccuracies

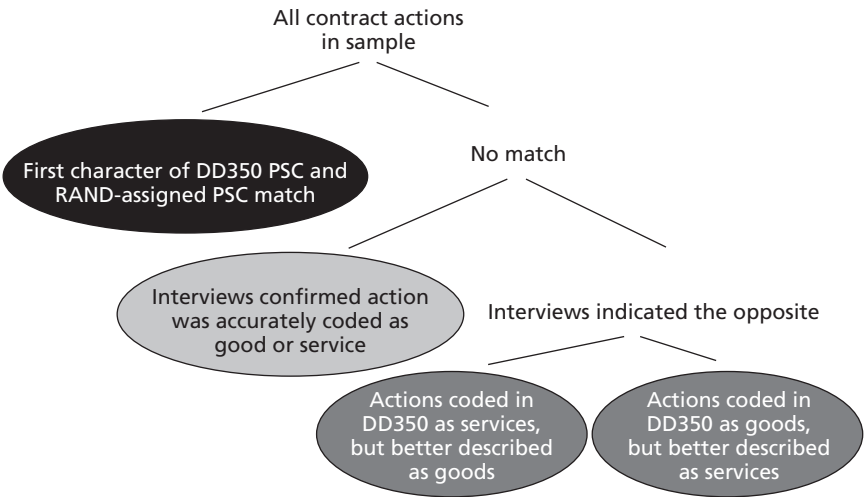
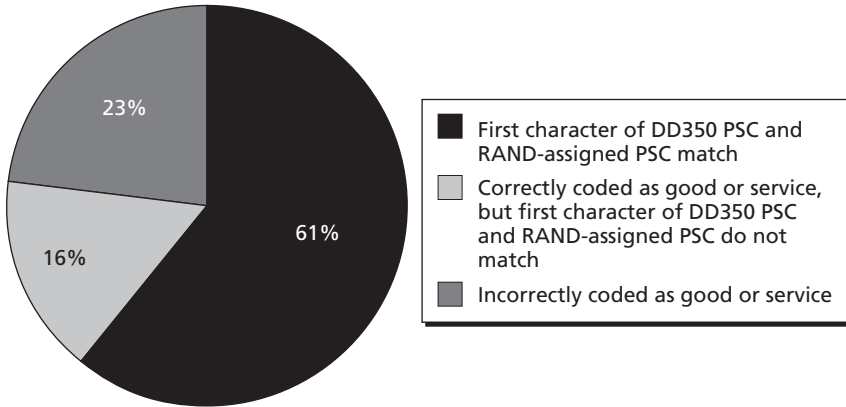


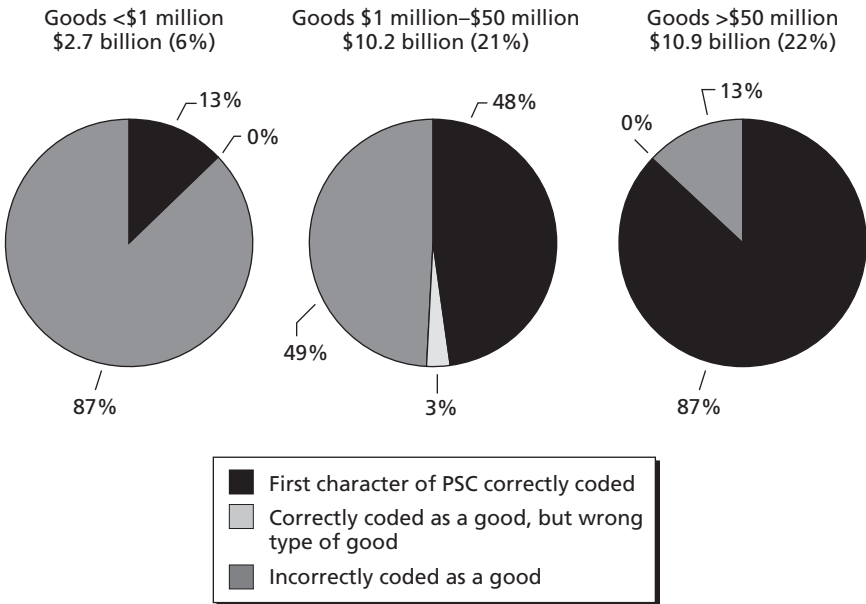
Figure 3.2**Estimated Accuracy of PSC Codes by Amount of Expenditures in Air Force FY02 DD350 Database, All Actions**

RAND MG274-3.2

NOTES: Percentages are based on survey data that have been reweighted to reflect the entire population of Air Force FY02 DD350 contract actions. Value of all contract actions totals \$49 billion.

For goods actions worth less than \$1 million, we estimate that 87 percent of the dollars should have been identified as expenditures for services. Actions in this dollar category of goods actions account for only 6 percent of the total Air Force FY02 DD350 dollars (\$2.7 billion). For goods actions worth between \$1 million and \$50 million, which account for 21 percent of the DD350 dollars (\$10.2 billion), approximately half the dollars should have been recorded as being for services. Goods actions valued at greater than \$50 million account for 22 percent of DD350 dollars (\$10.9 billion) and fare better in our analysis of accuracy: Only 13 percent of those dollars should have been coded as services. These results run counter to what we had expected. We had anticipated that small goods actions would be accurately coded, but that large goods actions might include the purchase of a variety of items, and therefore would be relatively difficult to code accurately with only one PSC.

Figure 3.3
Estimated Coding Inaccuracies for Air Force FY02 DD350 Actions Recorded as Goods, by Dollar Value of Contract Action



RAND MG274-3.3

NOTE: Percentages are based on survey data that have been reweighted to reflect the entire population of Air Force FY02 DD350 contract actions.

Following are some examples of DD350 actions that were incorrectly coded as goods rather than services:

- An action coded in the DD350 database as aircraft goods was primarily for installation of commercial engines (re-engining), plus designs and kits for reliability improvements to various aircraft parts (such as door seals and drain lines).
- An action coded as satellite goods was primarily for R&D for satellite system modernization.

- An action coded as computer hardware goods was primarily for developing computer system software and converting data to the new system.

Table 3.2 provides additional insight into how selected contract actions valued between \$1 million and \$50 million that were coded as goods in the DD350 database should be re-coded, based on our analysis. The table reflects our survey sample rather than the survey data extrapolated to the entire Air Force FY02 DD350 database.

The rows in Table 3.2 group expenditures by the first character of the PSC recorded in the DD350 database. The columns show the percentages of expenditures in each row that fall into each of the indicated RAND-assigned PSC categories. The boldface numbers in this table (and in Table 3.3) represent percentages of expenditures for which the first character of the primary RAND-assigned PSC and DD350 PSC matched.

Using the first row of Table 3.2 as an example, 17 percent of the expenditures in our sample that were recorded in the DD350 forms with a PSC starting with the number 1 were accurately coded—that is, we also assigned primary PSCs whose first character was the number 1 to those actions. Our analyses indicate that the remainder of these obligations should have been recorded as various types of

Table 3.2
Percentage of Expenditures in Survey Sample Reassigned to Other PSCs, Goods Actions Between \$1 Million and \$50 Million

RAND-Assigned PSCs													
Goods					Services								
	1	2	5	Other	A	D	J	K	M	R	Other	Total	
DD350 PSCs	1	17			18	4	26	18	4	1	13	100	
	2		71	3	22		5					100	
	5			68	12	20						100	

NOTE: Percentages are based on unweighted survey data.

services. For example, 18 percent should have been recorded as R&D (A), 4 percent should have been recorded as an automatic data processing and telecommunications service (D), 26 percent should have been recorded as a service related to maintenance, repair, and rebuilding of equipment (J), and so forth.

Table 3.2 illustrates that many actions between \$1 million and \$50 million that were recorded as goods were actually for R&D (A), maintenance (J), and modifications (K). One possible explanation for these discrepancies is that after a good is purchased, follow-on actions for services or ancillary activities related to the initial purchase of the good somehow retain the original PSC and thus escape detection as a service in the official records.

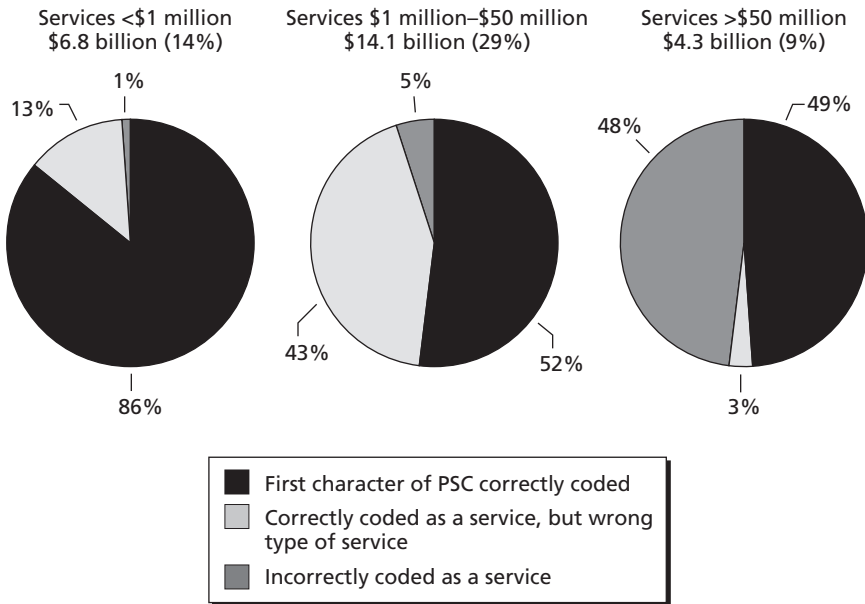
Contract Actions for Services. Figure 3.4 shows how our estimates of the coding inaccuracies for actions recorded as services in the DD350 database vary with the dollar value of the action.

Interestingly, the pattern illustrated in Figure 3.4 is almost the reverse of that in Figure 3.3. For service actions worth less than \$1 million (which made up 14 percent of Air Force FY02 DD350 dollars), we estimate that only 1 percent should have been recorded as goods actions. For actions worth between \$1 million and \$50 million, we estimate that only 5 percent of expenditures should have been recorded as goods actions, although 43 percent of the expenditures should have been coded as different services than what was indicated in the DD350 database. The coding for the largest services actions (those for more than \$50 million) is the most inaccurate: We estimate that 48 percent of the services expenditures should have been coded as goods.

Following are examples of DD350 service actions that were used to purchase goods:

- A satellite system R&D action that included initial production activities
- A systems engineering action that included depot spare parts replenishment.

Figure 3.4
Estimated Coding Inaccuracies for Air Force FY02 DD350 Actions Recorded as Services, by Dollar Value of Contract Action



RAND MG274-3.4

NOTE: Percentages are based on survey data that have been reweighted to reflect the entire population of Air Force FY02 DD350 contract actions.

Some examples of actions that were correctly coded as services but would be better described by a PSC other than the one listed in the DD350 database include the following:

- An equipment modification action that was primarily for education and training services
- A professional services action that included the testing and integration of new sensors for aircraft
- A professional services contract that covered engineering work to develop a kit for installing new communications equipment.

Tables 3.3 and 3.4 show the percentage of expenditures for contract actions identified in the DD350 as services that were reassigned to other PSCs.

Table 3.3 highlights the major reassignments for contract actions between \$1 million and \$50 million identified as services in the DD350 database. For example, 2 percent of the expenditures identified with a PSC beginning with “R” in the DD350 (professional, administrative, and management support services) should have been recorded as goods with a PSC that begins with 1. An R&D service code (A) would have been better for 3 percent of these dollars, and a modification-of-equipment service code (K) would have been better for 32 percent of the dollars. Only 19 percent of these dollars were correctly coded with the letter R—that is, we also assigned a primary PSC beginning with the letter R to these actions.

Table 3.4 highlights important PSC shifts for service contract actions for more than \$50 million. It shows that only 52 percent of the obligations for contract actions for more than \$50 million that were coded in the DD350 database as R&D services (A) were accurately coded. Our analyses indicate that a large percentage of these expenditures was actually used to purchase goods. It is possible that this discrepancy results from production activities that were the result of what initially were research and development projects.

Adequacy of the DD350 Data

As explained in the previous chapter, the PSC used to describe contract actions consists of four characters. The PSC manual classifies actions coded with PSCs that begin with a letter as services; codes that begin with numbers correspond to goods. The other three characters of the PSC provide more detailed information about the service or good being purchased. We used a broad definition of the adequacy of using a single PSC to describe a purchase: If more than one good or service was included in an action, and each of them could be described with codes that have the same first character, we considered a

Table 3.3
Percentage of Expenditures in Survey Sample Reassigned to Other PSCs, Service Actions Between \$1 Million and \$50 Million

		RAND-Assigned PSCs													Total
		Goods		Services											
		1	5	A	B	D	J	K	L	M	R	S	U	Other	
DD350 PSCs	A	6	6	72				2		1	12	1			100
	J		6				94								100
	K		8	36			7	6					42		100
	R	2		3	7	4	15	32	2		19	13		3	100
	S											70		30	100
	Other													100	100

NOTE: Percentages are based on unweighted survey data.

Table 3.4
**Percentage of Expenditures in Survey Sample Reassigned to Other PSCs,
Service Actions for More Than \$50 Million**

		RAND-Assigned PSCs						
		Goods			Services			
		1	2	5	A	K	L	Total
DD350	A	24	16	3	52	4	1	100
PSCs								

Note: Percentages are based on unweighted survey data.

single PSC to be adequate. Differences in the second, third, and fourth digits of the PSC were ignored. Note that this is a very generous definition of adequacy—e.g., maintenance and repair services begin with the letter J but could cover anything from maintenance of nuclear ordnance (code J011) to upkeep of live animals (code J088).

Table 3.5 summarizes our results for adequacy, which are extrapolated from our survey sample to the Air Force FY02 DD350 population. For 89 percent of the contract actions, one PSC was adequate to describe what was purchased. However, these actions represented only 73 percent of the DD350 dollars. Contract actions for which one PSC was inadequate to fully describe the services and/or goods represented 27 percent of the dollars included in the Air Force FY02 DD350 data, or just under \$14 billion.

Table 3.5
**Estimated Adequacy of a Single PSC to Describe FY02 Air Force Contract
Actions in the DD350 Database**

	Single PSC Adequate	Single PSC Not Adequate ^a	Total
Contract Actions (%)	89	11	100
Contract Action Dollars (%)	73	27	100

^aMultiple PSCs with differing first characters are needed to describe the goods and/or services purchased by these contract actions.

NOTE: Percentages are based on survey data that have been reweighted to reflect the entire population of Air Force FY02 DD350 contract actions.

The following are examples of contract actions identified during our interviews that involved activities of more than one distinct type:

- A radar purchase (a good) that included some support services for installation
- An aircraft purchase (a good) that included logistics and training support (a service)
- Services for locating nonstandard parts that included costs for purchasing parts (goods).

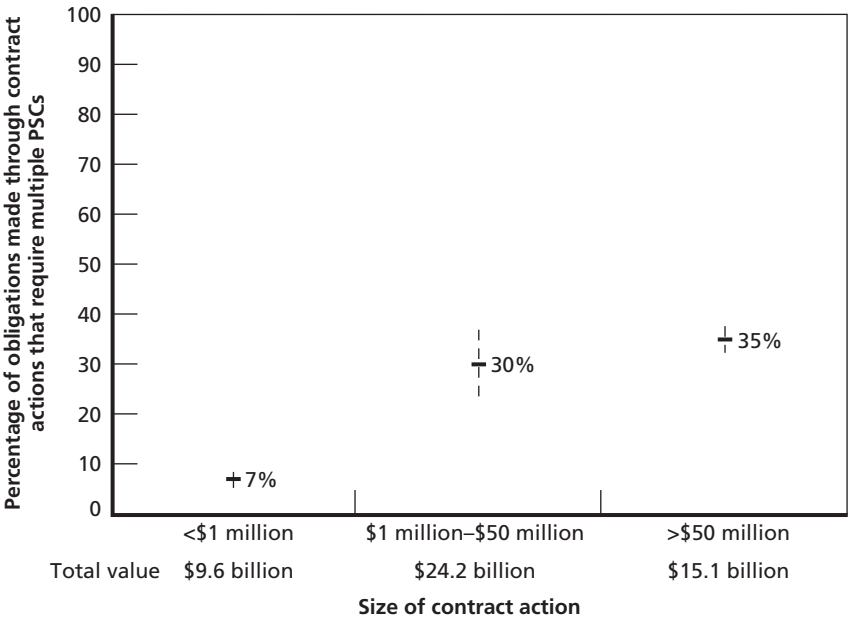
In Figure 3.5, we examine the adequacy of a single PSC for actions that fell within three dollar-size categories: less than \$1 million, between \$1 million and \$50 million, and greater than \$50 million. The figure shows the percentage of obligations in each dollar-size category (plus confidence intervals on those estimates) associated with contract actions that require more than one PSC to fully describe the purchase.

Figure 3.5 indicates that larger actions are indeed more likely to include expenditures for multiple activities. The figure shows that 35 percent of the dollars for actions worth more than \$50 million and 30 percent of the dollars for actions valued between \$1 million and \$50 million are for contract actions that require multiple PSCs. By comparison, only 7 percent of the dollars for actions worth less than \$1 million require multiple PSCs.

We next examine whether certain categories of goods or services actions are more likely to contain multiple activities. In Figure 3.6, we illustrate the adequacy of a single PSC for actions that fall within five PSC groupings according to the DD350 data: R&D, other services, aircraft and components, engines and components, and other goods.² As in Figure 3.5, Figure 3.6 shows the estimated

² The R&D category covers PSCs beginning with the letter A. The other services category covers PSCs beginning with letters other than A. The aircraft and components category covers PSCs beginning with a 1. The engines and components category covers PSCs beginning

Figure 3.5
Estimated Adequacy of Using Only a Single PSC to Describe Air Force FY02 DD350 Contract Actions, by Dollar Size of Contract Action



RAND MG274-3.5

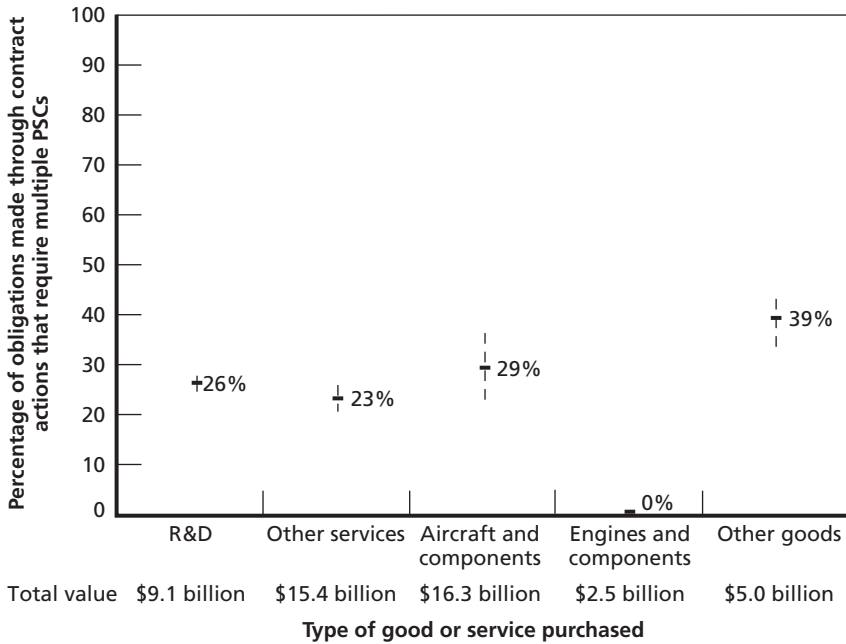
NOTES: Percentages are based on survey data that have been reweighted to reflect the entire population of Air Force FY02 DD350 contract actions. Dashed vertical lines represent 95-percent confidence intervals.

percentages of Air Force FY02 DD350 contract dollars that are made by contract actions that require more than one PSC to fully describe the purchase.

Figure 3.6 illustrates that even though the criteria we used to determine whether multiple PSCs are required are fairly loose (the PSCs must differ at the first character), the need for multiple PSCs is widespread. For example, our analyses indicate that 29 percent of the

with a 2. The other goods category covers PSCs beginning with a number other than 1 or 2. See Appendix B for further information.

Figure 3.6
Estimated Adequacy of Using Only a Single PSC to Describe Air Force FY02 DD350 Contract Actions, by PSC Category



RAND MG274-3.6

NOTES: Percentages are based on survey data that have been reweighted to reflect the entire population of Air Force FY02 DD350 contract actions. Dashed vertical lines represent 95-percent confidence intervals. There is no confidence interval for engines and components because the variance of the estimate is zero.

dollars within the “aircraft and components” category required multiple PSCs to be fully described. Obligations in the “engines and components” category proved to be the sole exception: none of the actions in this category required multiple PSCs. These actions are generally for subsystems and specific items, which involve smaller dollar amounts that are less likely to involve multiple activities.

Figures 3.5 and 3.6 and Table 3.5 raise the question of how much more information could be “captured” by the DD350 if the form allowed the inclusion of more than one PSC (with corresponding dollar amounts) to describe a contract action. We found that even

for those contract actions for which more than one PSC was necessary, the *primary* PSC (the one that we determined described the most contract dollars covered by the action) accounted for 60 to 80 percent of the dollars in the action (based on unweighted survey data).³ Considering Air Force FY02 DD350 data as a whole, allowing only one PSC to describe contract actions prevents an accurate characterization of 5 to 11 percent of the total contract dollars, or roughly \$2 billion to \$5 billion.

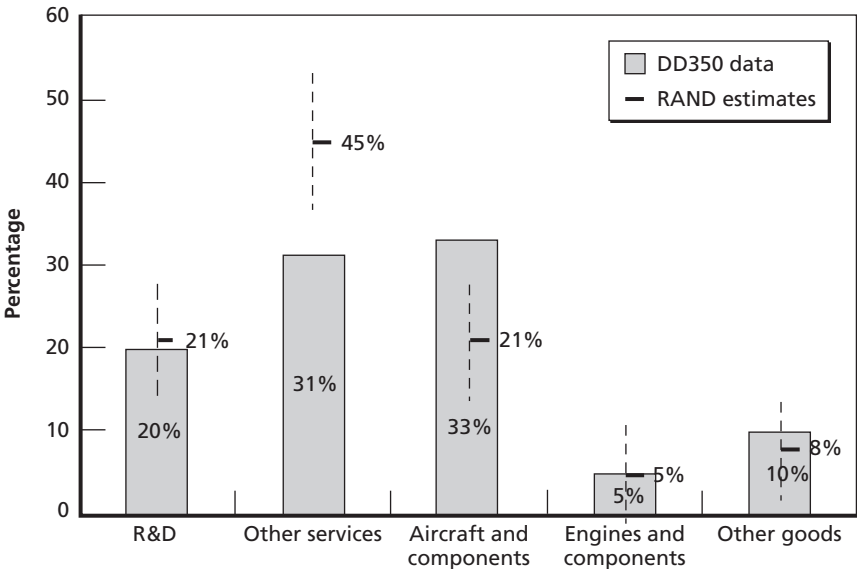
As previously discussed, the existing set of PSCs did not allow us to identify certain types of purchases, such as warranties and specific kinds of engineering studies. Introducing new codes for these activities enabled us to better identify 5 to 6 percent of the total contract dollars. Using only a single PSC per action, these additional codes identified about 5 percent of the dollars. If multiple PSCs were allowed, these additional codes identified 6 percent of dollars. We return to these issues in the next chapter.

Implications for Tracking Service Expenditures

The coding problems described in this chapter lead to the conclusion that FY02 DD350 data on Air Force expenditures for goods and services present a somewhat misleading picture of actual expenditures. Figure 3.7 shows the differences between the mix of goods and services purchased by the Air Force according to DD350 data on contract actions and the mix of goods and services based on our survey data. The RAND estimates allow for both more accurate coding of

³ The upper and lower bounds for this range are due to different treatments of actions for which contracting officers were unable to break out the dollars associated with distinct goods and services purchased through the contract action. The lower end of this range results when expenditures are evenly spread across all the PSCs identified for a component of the contract actions, where multiple PSCs are needed to describe the goods or services, but the contracting officer was not able to assign dollars to each of the PSCs. The upper end of the interval results when expenditures are attributed to the primary PSC for that part of the contract action.

Figure 3.7
Share of Overall Air Force FY02 DD350 Expenditures by Purchase Category, RAND Estimates Versus DD350 Data



RAND MG274-3.7

NOTES: Percentages are based on survey data that have been reweighted to reflect the entire population of Air Force FY02 DD350 contract actions. Dashed vertical lines represent 95-percent confidence intervals.

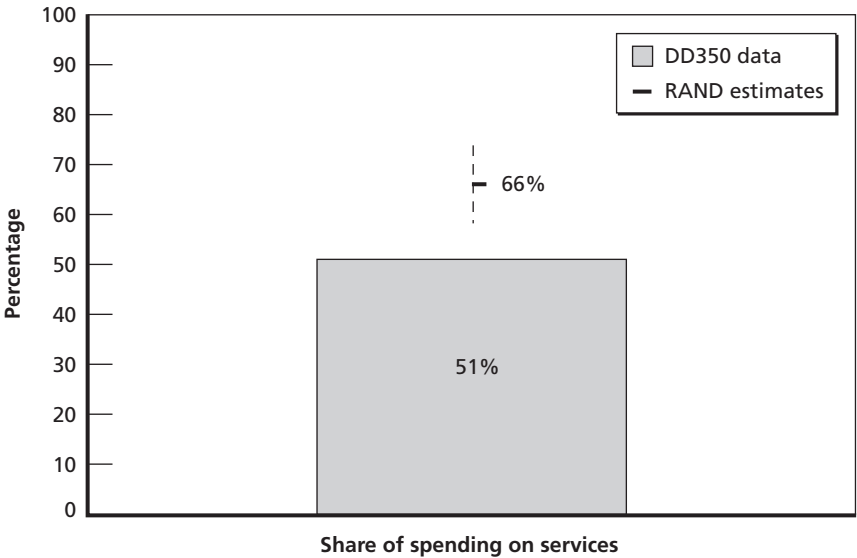
the primary PSC and the option of using multiple PSCs to characterize a contract action. The bars in the figure show the shares of overall Air Force FY02 DD350 expenditures for various categories of purchases, based on DD350 PSCs. The horizontal dashes represent the distribution of purchases based on our interviews with contracting officers, and the dotted vertical lines indicate the 95-percent confidence interval for the estimates.

The two categories for which there are significant differences between our estimates and the DD350 data are other services and aircraft and components. We found that a much higher share of other services was purchased than is indicated by the DD350 data: 45 percent according to our estimates as opposed to only 31 percent

according to the DD350 data. We found that fewer dollars went to the aircraft and components category than were recorded in the DD350 database—the DD350 data indicated that 33 percent of spending went to this category, while our survey results led us to conclude that the actual share was only 21 percent.⁴ On the other hand, the share of expenditures for R&D, engines and components, and other goods appears to be accurately represented by DD350 data.

The end result of the differences between DD350 data and the RAND estimates is shown in Figure 3.8.

Figure 3.8
Percentage of Air Force Spending on Services, RAND Estimate Versus Air Force FY02 DD350 Data



RAND MG274-3.8

NOTES: Percentages are based on survey data that have been reweighted to reflect entire Air Force FY02 DD350 database. The dashed vertical line represents the 95-percent confidence interval.

⁴ The differences for other services and aircraft and components are statistically significant, because, as shown in Figure 3.7, the confidence intervals for these two categories do not contain the percentage of expenditures that is derived from the DD350 database.

Figure 3.8 shows that, according to Air Force FY02 DD350 data, services accounted for 51 percent of contract purchases. We estimate that the actual percentage of spending on services is greater—66 percent, as represented by the horizontal dash in the figure.⁵ Once again, the dotted vertical line represents a 95-percent confidence interval, and the difference between the RAND estimate and percentage based on DD350 data is statistically significant.

⁵ As noted in Chapter Two, there were two approaches available for allocating dollars to actions requiring multiple PSCs when the contracting officer was unable to provide an allocation. One approach was to allocate all dollars to the primary PSC, and the other approach was to spread the dollars evenly across all the PSCs. Our estimate of the percentage of expenditures for services, shown in Figure 3.8, is based on the first approach. We found that the approach used to allocate dollars requiring multiple PSCs made little difference in the estimate.

Summary and Policy Recommendations

In this chapter, we summarize our findings from this study, discuss in further detail potential causes of problems with DD350 data, and recommend actions the Air Force could take in the short term and long term to help improve the usefulness of DD350 data for future spend analyses.

Summary of Findings

Table 4.1 summarizes our most important findings on the accuracy and adequacy of DD350 data for conducting spend analyses. We conclude that analyses of DD350 data provide useful information about the nature of the Air Force's expenditures.

However, the Air Force should understand that (1) DD350-based analyses will likely underrepresent the range of goods and services purchased because of limited information from a single PSC and (2) these analyses will likely be distorted by miscodings, particularly for several categories of services. Supplemental data are needed to develop a detailed understanding of the types of goods and services the Air Force purchases and to construct appropriate purchasing and supply management strategies.

Table 4.1
Summary of Findings on Adequacy and Accuracy of Air Force FY02 DD350 Data

Issue	Findings
Accuracy of PSC coding in DD350 database	The PSC for 50 percent of contract actions (39 percent of contract dollars) is coded inaccurately. Services are undercounted.
Adequacy of using a single PSC in DD350 database	More than one distinct good and/or service was purchased in 11 percent of contract actions (27 percent of contract dollars). 5 percent to 11 percent of dollars are associated with secondary PSCs.
How well the available PSCs describe Air Force purchases	Several important categories of activities are not fully captured in the current codes. New PSCs could be used to better identify at least 5 percent to 6 percent of contract dollars.

Potential Reasons for Discrepancies

The results of our analyses raise the question of what lies behind the pervasive discrepancies between the data recorded in the DD350 forms and the actual goods and/or services that are purchased. During our survey interviews and subsequent conversations with Air Force contracting officers, we learned of several potential factors that can lead to miscodings. Some explanations for the discrepancies are hypothetical, and further research is required to fully understand the relevant issues.

First, *we learned firsthand how difficult it can be to assign the right code to an activity*. Chapter Two presents several examples of contract actions for which a number of different PSCs could apply and cases in which there appeared to be no available PSC to describe the specific activity.

Second, *it may be that some PSCs are simply being carried forward to subsequent actions or contracts*, even though the goods and/or services being purchased are changing from one contract action to another. For example, in a contract for aircraft modification, one action may cover engineering support to design the installation process, one action may cover the modification kits themselves, and another

action may cover installation. Contracting officers may end up using the original PSC to describe each of these distinct activities. As another example, when a development effort transitions into the production of prototypes and then into low-rate initial production, contracting officers may carry forward information from one contract action to the next without recoding the actions to reflect the change in activities.

Third, *contracting officers fill out the DD350 forms, but they may not be the individuals who are most knowledgeable about the exact nature of the goods and/or activities being purchased.* A contracting officer's basic understanding of a good or service may not be sufficient to enable him or her to distinguish from among many potentially relevant PSCs. Several times during the course of our surveys, the contracting officers we interviewed brought in experts to help with technically complex cases.

Finally, *contracting officers view the DD350 form as the final formality in completing a contract action.* Many contracting officers told us that the computer program they use to fill out the DD350 form electronically is difficult to navigate, and the program often rejects the most accurate and descriptive information because the data entered do not pass certain consistency checks that are not transparent to the user. In addition, many contracting officers appeared to be unaware that the DD350 data are now being used for important analyses related to purchasing and supply management strategies.¹ Therefore, contracting officers may be more concerned with getting the DD350 system to accept the transaction than with fine-tuning the description of the purchase.

¹ Several interviewees did believe that the Air Force and small-business community do pay attention to the socioeconomic data reported on the DD350 form (e.g., size of a company, ethnic group and gender of business owner).

Recommendations to Improve the Usefulness of DD350 Data

The DD350 system is not exclusively an Air Force system, so the Air Force does not control the design of the form or the software used to enter data into the DD350 database; however, we believe the Air Force can take several steps over the short term and long term to improve the usefulness of these data for spend analyses.

Over the short term, it would be helpful to communicate to the entire contracting workforce that these data are now being used to perform detailed analyses to support implementation of new purchasing and supply management strategies. In addition, the Air Force could collect more detailed data on contracts that fall within the “problem” PSC and dollar categories (identified in Chapter Three) to supplement DD350 data for ongoing spend analyses. With enough additional data, the Air Force may be able to use statistical analyses to develop guidelines for reallocating dollars among activities to better reflect the realities of Air Force purchases. For example, such an analysis might suggest that x percent of R&D dollars should be reallocated to aircraft-related purchase categories.

Over the long term, the Air Force may be able to work with other branches of DoD and federal agencies to refine the list of PSCs to include codes that better describe Air Force activities. Potential new codes based on this study are discussed in Chapter Two and listed in Appendix B.²

The Air Force may also want to evaluate the costs and benefits of being able to describe secondary activities in more detail. Based on our analyses, allowing for additional PSCs and corresponding dollar amounts would enhance the Air Force’s ability to describe an additional 5 to 11 percent of DD350 contract dollars, which equates to \$2 billion to \$5 billion for FY02. For detailed analyses of specific

² It should be noted, however, that creating additional codes without eliminating other less-useful codes could introduce the possibility of increased coding errors. Perhaps the Air Force could restrict the set of codes its contracting officers can use to include only those that are most appropriate and descriptive.

classes of goods and/or services, this additional information could be quite helpful in constructing purchasing strategies. However, lobbying for and implementing changes to the DD350 form and the additional training those changes would require would not be without costs. In addition, entering additional details into the DD350 form would require more time and attention from contracting officers to avoid the possibility of increasing, rather than decreasing, coding problems.

Finally, the Air Force may benefit from providing targeted PSC coding training to contracting officers, particularly those who are working with technically complex contracts or contracts that include many different types of activities. Such training should include specific guidance for resolving the types of coding issues discussed in Chapter Two.

Individual Contracting Action Report Data Fields

Table A.1 presents the data fields on the October 2002 version of the Individual Contracting Action Report form, also known as the DD350 form.

Table A.1
Sample DD350 Form

Data Field Number	Data Field Description	Remarks
A1	Type of Report	(0) Original; (1) Canceling; or (2) Correcting
A2	Report Number	
A3	Contracting Office	
A3A	A3A Reporting Agency FIPS 95 Code	
A3B	Contracting Office Code	
A4	Name of Contracting Office	
B1	Contract Identification Information	
B1A	Contract Number	
B1B	Origin of Contract	(A) DoD; (B) NASA; or (C) Other Non-DoD Agency
B1C	Bundled Contract	(Y) Yes; or (N) No
B1D	Bundled Contract Exception	(A) Mission Critical; (B) OMB Circular A-76; or (C) Other
B1E	Performance-Based Service Contract	(Y) Yes; or (N) No
B2	Modification, Order, or Other ID Number	

Table A.1—Continued

Data Field Number	Data Field Description	Remarks
B3	Action Date	(yyyymmdd)
B4	Completion Date	(yyyymmdd)
B5	Contractor Identification Information	
B5A	Contractor Identification Number (DUNS)	
B5B	Government Agency	(Y) Yes; or (N) No
B5C	CAGE Code	
B5D	Contractor Name and Division Name	
B5E	Contractor Address	
B5F	Taxpayer Identification Number	
B5G	Parent Taxpayer Identification Number	
B5H	Parent Name	
B6	Principal Place of Performance	
B6A	City or Place Code	
B6B	State or Country Code	
B6C	City or Place and State or Country Name	
B7	Type of Obligation	(1) Obligation; (2) Deobligation; or (3) No Dollars Obligated or Deobligated
B8	Obligated or Deobligated Dollars	<i>Enter Whole Dollars Only</i>
B9	Foreign Military Sale	(Y) Yes; or (N) No
B10	Multiyear Contract	(Y) Yes; or (N) No
B11	Total Estimated Contract Value	<i>Enter Whole Dollars Only</i>
B12	Principal Product or Service	
B12A	Federal Supply Class or Service Code	
B12B	DoD Claimant Program Code	
B12C	Program, System, or Equipment Code	

Table A.1—Continued

Data Field Number	Data Field Description	Remarks
B12D	NAICS Code	
B12E	Name or Description	
B12F	EPA-Designated Product(s)	(A) EPA-Designated Product(s) with Minimum Recovered Material Content; (B) FAR 23.405(c)(1) Justification; (C) FAR 23.405(c)(2) Justification; (D) FAR 23.405(c)(3) Justification; or (E) No EPA-Designated Product(s) Acquired
B12G	Recovered Material Clauses	(A) FAR 52.223-4; or (B) FAR 52.223-4 and FAR 52.223-9
B13	Kind of Action	
B13A	Contract or Order	(1) Letter Contract; (3) Definitive Contract; (4) Order under an Agreement; (5) Order under Indefinite-Delivery Contract; (6) Order under Federal Schedule; (7) BPA Order under Federal Schedule; (8) Order from UNICOR or JWOD; or (9) Award under FAR Part 13
B13B	Type of Indefinite-Delivery Contract	(A) Requirements Contract (FAR 52.216-21); (B) Indefinite-Quantity Contract (FAR 52.216-22); or (C) Definite-Quantity Contract (FAR 52.216-20)
B13C	Multiple or Single Award Indefinite-Delivery Contract	(M) Multiple Award; or (S) Single Award
B13D	Modification	(A) Additional Work (new agreement); (B) Additional Work (other); (C) Funding Action; (D) Change Order; (E) Termination for Default; (F) Termination for Convenience; (G) Cancellation; (H) Exercise of an Option; or (J) Definitization
B13E	Multiple Award Contract Fair Opportunity	(A) Fair Opportunity Process; (B) Urgency; (C) One/Unique Source; (D) Follow-On Contract; or (E) Minimum Guarantee
B13F	Indefinite-Delivery Contract Use	(A) Government-Wide; (B) DoD-Wide; (C) DoD Department or Agency Only; or (D) Contracting Office Only
B13G	Indefinite-Delivery Contract Ordering Period Ending Date	(yyyyymmdd)
B14	CICA Applicability	(A) Pre-CICA; (B) CICA Applicable; (C) Simplified Acquisition Procedures Other than FAR Subpart 13.5; or (D) Simplified Acquisition Procedures Pursuant to FAR Subpart 13.5

Table A.1—Continued

Data Field Number	Data Field Description	Remarks
B15	Information Technology Products or Services	(A) Commercially Available Off-the-Shelf Item; (B) Other Commercial Item of Supply; (C) Nondevelopmental Item Other than Commercial Item; (D) Other Noncommercial Item of Supply; (E) Commercial Service; or (F) Noncommercial Service
B16	Clinger-Cohen Act Planning Compliance	(Y) Yes; or (N) No
Do not complete Part C if Line B5B is coded Y.		
C1	Synopsis	(A) Synopsis Only; (B) Combined Synopsis/Solicitation; or (N) Not Synopsized
C2	Reason Not Synopsized	(A) Urgency; (B) FAR 5.202(a)(13); (C) SBA/OFPP Pilot Program; or (Z) Other Reason
C3	Extent Competed	(A) Competed Action; (B) Not Available for Competition; (C) Follow-On to Competed Action; or (D) Not Competed
C4	Sea Transportation	(Y) Yes—Positive Response to DFARS 252.247-7022 or 252.212-7000(c)(2); (N) No—Negative Response to DFARS 252.247-7022 or 252.212-7000(c)(2); or (U) Unknown—No Response or Provision Not Included in Solicitation
C5	Type of Contract	(A) Fixed-Price Redetermination; (J) Firm-Fixed-Price; (K) Fixed-Price Economic Price Adjustment; (L) Fixed-Price Incentive; (M) Fixed-Price Award-Fee; (R) Cost-Plus-Award-Fee; (S) Cost Contract; (T) Cost-Sharing; (U) Cost-Fixed-Fee; (V) Cost-Plus-Incentive-Fee; (Y) Time and Materials; or (Z) Labor Hour
C6	Number of Offerors Solicited	(1) One; or (2) More than One
C7	Number of Offers Received	

Table A.1—Continued

Data Field Number	Data Field Description	Remarks
C8	Solicitation Procedures	(A) Full and Open Competition—Sealed Bid; (B) Full and Open Competition—Competitive Proposal; (C) Full and Open Competition—Combination; (D) Architect-Engineer; (E) Basic Research; (F) Multiple Award Schedule; (G) Alternative Sources; (K) Set-Aside; or (N) Other than Full and Open Competition
C9	Authority for Other than Full and Open Competition	(1A) Unique Source; (1B) Follow-On Contract; (1C) Unsolicited Research Proposal; (1D) Patent or Data Rights; (1E) Utilities; (1F) Standardization; (1G) Only One Source—Other; (2A) Urgency; (3A) Particular Sources; (4A) International Agreement; (5A) Authorized by Statute; (5B) Authorized Resale; (6A) National Security; or (7A) Public Interest
C10	Subject to Labor Standards Statutes	(A) Walsh-Healey Act; (C) Service Contract Act; (D) Davis-Bacon Act; or (Z) Not Applicable
C11	Cost or Pricing Data	(Y) Yes—Obtained; (N) No—Not Obtained; or (W) Not Obtained—Waived
C12	Contract Financing	(A) FAR 52.232-16; (C) Percentage of Completion Progress Payments; (D) Unusual Progress Payments or Advance Payments; (E) Commercial Payments; Financing; (F) Performance-Based Financing; or (Z) Not Applicable
C13	Foreign Trade Data	
C13A	Place of Manufacture	(A) U.S.; or (B) Foreign
C13B	Country of Origin Code	
C14	Commercial Item	(Y) Yes—FAR 52.212-4 Included; or (N) No—FAR 52.212-4 Not Included
Do not complete Part D if Line B5B is coded Y or if Line B13A is coded 6.		
D1	Type of Contractor	
D1A	Type of Entity	(A) Small Disadvantaged Business (SDB) Performing in U.S.; (B) Other Small Business (SB) Performing in U.S.; (C) Large Business Performing in U.S.; (D) JWOD Participating Nonprofit Agency; (F) Hospital; (L) Foreign Concern or Entity; (M) Domestic Firm Performing Outside U.S.; (T) Historically Black College or University (HBCU); (U) Minority Institution (MI); (V) Other Educational or (Z) Other Nonprofit

A.1—Continued

Data Field Number	Data Field Description	Remarks
D1B	Women-Owned Business	(Y) Yes; or (N) No; or (U) Uncertified
D1C	HUBZone Representation	(Y) Yes; or (N) No
D1D	Ethnic Group	(A) Asian-Indian American; (B) Asian-Pacific American; (C) Black American; (D) Hispanic American; (E) Native American; (F) Other SDB Certified or Determined by SBA; or (Z) No Representation
D1E	Veteran-Owned Small Business	(A) Service-Disabled Veteran; or (B) Other Veteran
D2	Reason Not Awarded to SDB	(A) No Known SDB Source; (B) SDB Not Solicited; (C) SDB Solicited and No Offer Received; (D) SDB Solicited and Offer Was Not Low; or (Z) Other Reason
D3	Reason Not Awarded to SB	(A) No Known SB Source; (B) SB Not Solicited; (C) SB Solicited and No Offer Received; (D) SB Solicited and Offer Was Not Low; or (Z) Other Reason
D4	Set-Aside or Preference Program	
D4A	Type of Set-Aside	(A) None; (B) Total SB Set-Aside; (C) Partial SB Set-Aside; (D) Section 8(a) Set-Aside or Sole Source; (E) Total SDB Set-Aside; (F) HBCU or MI Total Set-Aside; (G) HBCU or MI—Partial Set-Aside; (H) Very Small Business Set-Aside; (J) Emerging Small Business Set-Aside; (K) HUBZone Set-Aside or Sole Source; (L) Combination HUBZone and 8(a)
D4B	Type of Preference	Type of Preference: (A) None; (B) SDB Price Evaluation Adjustment—Unrestricted; (C) SDB Preferential Consideration—Partial SB Set-Aside; (D) HUBZone Price Evaluation Preference; or (E) Combination HUBZone Price Evaluation Preference and SDB Price Evaluation Adjustment
D4C	Premium Percent	
D7	Small Business Innovation Research (SBIR) Program	(A) Not a SBIR Program Phase I, II, or III; (B) SBIR Program Phase I Action; (C) SBIR Program Phase II Action; or (D) SBIR Program Phase III Action

Table A.1—Continued

Data Field Number	Data Field Description	Remarks
D8	Subcontracting Plan—SB, SDB, HBCU, or MI	(A) Plan Not Included—No Subcontracting Possibilities; (B) Plan Not Required; (C) Plan Required—Incentive Not Included; or (D) Plan Required—Incentive Included
D9	Small Business Competitiveness Demonstration Program	(Y) Yes; or (N) No
D10	Size of Small Business	Employees (A) 50 or fewer (B) 51–100 (C) 101–250 (D) 251–500 (E) 501–750 (F) 751–1000 (G) Over 1000 Annual Gross Revenues (M) \$1 million or less (N) Over \$1 million–\$2 million (P) Over \$2 million–\$3.5 million (R) Over \$3.5 million–\$5 million (S) Over \$5 million–\$10 million (T) Over \$10 million–\$17 million
D11	Emerging Small Business	(Y) Yes; or (N) No
E1	Contingency, Humanitarian, or Peacekeeping Operation	(Y) Yes; or Leave Blank
E2	Cost Accounting Standards Clause	(Y) Yes; or Leave Blank
E3	Requesting Agency Code (FIPS 95)	
E4	Requesting Activity Code	
E5	Number of Actions	
E6	Payment by Governmentwide Purchase Card	(Y) Yes; or Leave Blank
F1	Name of Contracting Officer or Representative	
F2	Signature	
F3	Telephone Number	

Product Service Code Categories Used in the Analyses

This appendix lists the PSC categories used in this study (see Chapter Two for more information). Service categories (PSCs that begin with a letter code) are listed first, followed by goods categories (PSCs that begin with a number code). The boldface lines denote a single PSC or group of PSCs that was used in the analysis. The bulleted lists under those lines indicate how the PSCs were subdivided.

PSC Service Categories Listed by First Character of PSC

A: R&D

- AC: RDT&E for Defense Systems
- AD: RDT&E for Defense—Other
- AR: RDT&E for Space
- A Other: All other types of RDT&E activities

B: Special Studies and Analyses—Not R&D

- B56: Category created by RAND to represent well-defined engineering support activities that typically result in a report (e.g., on how to address obsolescence problems for a set of parts) and/or a set of data
 - B560: Aircraft
 - B561: Space
- B Other: All other PSCs that begin with the letter B. These are the B codes found in the official PSC list.

D: Automatic Data Processing (ADP) and Telecommunication Services

J: Maintenance, Repair, and Rebuilding of Equipment

- J1: Category created by RAND to represent warranties. The last two digits of this code are the first two digits of the goods codes to which the warranty applies
- J Other: All other PSCs that begin with the letter J. These are the J codes found in the official PSC list.

K: Modification of Equipment

- K1: Category created by RAND to represent engineering support activities associated with modifications
- K Other: All other PSCs that begin with the letter K. These are the K codes found in the official PSC list.

L: Technical Representative Services

M: Operation of Government-Owned Facility

N: Installation Equipment

R: Professional, Administrative, and Management Support Services

- R4: Professional Services
- R Other: The remainder of the R category covering Administrative and Management Support Services

S: Utilities and Housekeeping Services

- S1: Utilities
- S2: Housekeeping Services

Other Services

- C: Architect and Engineering Services—Construction
- E: Purchase of Structures and Facilities
- F: Natural Resource Management
- G: Social Services

- H: Quality Control, Testing, and Inspection Services
- P: Salvage Services
- Q: Medical Services
- T: Photographic, Mapping, Printing, and Publication Services
- U: Education and Training Services
- V: Transportation, Travel, and Relocation Services
- W: Lease or Rental of Equipment
- X: Lease or Rental of Facilities
- Y: Construction of Structures and Facilities
- Z: Maintenance, Repair, or Alteration of Real Property

PSC Goods Categories Listed by First Two Characters of PSC

“Aircraft and Components” Category

- 10: Weapons
- 11: Nuclear Ordnance
- 12: Fire Control Equipment
- 13: Ammunition and Explosives
- 14: Guided Missiles
- 15: Aircraft and Airframe Structural Components
- 16: Aircraft Components and Accessories
- 17: Aircraft Launching, Landing, and Ground Handling Equipment
- 18: Space Vehicles
- 19: Ships, Small Craft, Pontoons, and Floating Docks

“Engines and Components” Category

- 20: Ship and Marine Equipment
- 21: Unassigned
- 22: Railway Equipment
- 23: Ground Effect Vehicles
- 24: Tractors
- 25: Vehicular Equipment Components
- 26: Tires and Tubes

- 27: Unassigned
- 28: Engines, Turbines, and Components
- 29: Engine Accessories

Other Goods

- All other goods PSCs, except those starting with the numbers 1 or 2.

Survey Questionnaire for Contracting Personnel

This appendix contains the questionnaire we used to gather information from Air Force contracting officers about the contract actions in our sample of FY02 DD350 actions. We used a subset of the collected information for the analyses described in this report.

Hello, this is _____, and I am calling on behalf of RAND, a non-profit research institute. I sent you a letter recently about a study we are conducting for General Scott in SAF/AQC. We are helping SAF/AQC better understand what the Air Force buys, who it buys it from, and how purchasing policies and practices might be improved. As part of this process we are examining purchases recorded in the DD350 database and would like to ask you a few question about the two contract actions identified in the letter I sent you.

We will not identify your name or the individual contract actions selected for our study. We will also send you copy of the draft report when it is available this summer.

Before we begin, do you have any questions about the study?

1. Confirm address of contracting officer.

Address correct..... ☐₁

Address incorrect..... ☐₂

Address: _____

2. Are you familiar with the contract actions that were described in the letter I sent you?

Do you have the documentation for these actions available?

I'd like to start by verifying the information we have about the first contract action.

[Ask the contracting officer for each of the following pieces information. If different from what is in DD350, enter new data.]

3. Contracting office

Same as DD350 ☐₁

Different than DD350 ☐₂ _____

Don't know ☐₃

4. Total amount of contract action
 Same as DD350 ☐₁
 Different than DD350 ☐₂ \$ _____
 Don't know ☐₃
5. Name and address of contractor
 Same as DD350 ☐₁
 Different than DD350 ☐₂
 Name of contractor _____
 Contractor address _____
 Don't know ☐₃
6. Contractor's DUNS number
 Same as DD350 ☐₁
 Different than DD350 ☐₂ _____
 Don't know ☐₃
7. As far as you know, is this contractor part of a larger or parent company?
 Yes ☐₁ 7a. What is the name and address of the larger or parent company?
 Name _____
 City and state _____
 Don't know ☐₁
- 7b. What is the DUNS number of the larger or parent company?
 DUNS _____
 Don't know ☐₃
- No ☐₂
 Don't know ☐₃

8a. What is the start date for this contract action?

Same as DD350☐₁

Different than DD350☐₂ _____ [mm/yy]

Don't know☐₃

8b. Is this start date for the contract action or the entire contract?

Contract action☐₁

Entire contract☐₂

Don't know☐₃

9a. What is the end date or completion date for this contract action?

Same as DD350☐₁

Different than DD350☐₂ _____ [mm/yy]

Don't know☐₃

9b. Is this end date for the contract action or the entire contract?

Contract action☐₁

Entire contract☐₂

Don't know☐₃

10. Please describe the different types of services (and goods) purchased under this contract action.

Description of Service or Good	Service	Good	4-Digit PSC	Amount	Percent of Total Amount
10a. _____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____	\$ _____	_____
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
10b. _____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____	\$ _____	_____
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
10c. _____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____	\$ _____	_____
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
10d. _____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____	\$ _____	_____
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
10e. _____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____	\$ _____	_____
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		
_____	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	_____		

11. What type of contract action is this? (E.g., fixed price, time and materials, etc.)

- Fixed price redetermination.....☐1
- Firm fixed price.....☐2
- Fixed price econ price adjustment....☐3
- Fixed price incentive.....☐4
- Fixed price award fee.....☐5
- Cost plus award fee.....☐6
- Cost contract.....☐7
- Cost sharing.....☐8
- Cost plus fixed fee.....☐9
- Cost plus incentive fee.....☐10
- Time and materials.....☐11
- Labor hour.....☐12
- Other.....☐13 Specify _____

Characteristics of Contract Actions for Which Interviews Were Completed

Table D.1 on the following pages describes the 243 contract actions for which interviews with contracting officers were completed, by dollar size of the contract action and the first character of the PSC for the contract action in the DD350 database. Table D.2 reports the total value of the contract actions shown in each cell of Table D.1. The analysis in this report is based on these 243 contract actions.

Table D.1
Contract Actions in Analysis Sample, by Dollar Size and PSC

First Character of PSC and Type of Contract Action	Size of Contract Action							Total
	\$0–\$100K	\$100K– \$500K	\$500K– \$1M	\$1M– \$10M	\$10M– \$50M	\$50M– \$100M	> \$100M	
Goods								
1 Aircraft and components	0	1	1	9	2	5	18	36
2 Engines and components	0	1	1	6	2	0	1	11
Other Goods	0	2	1	9	3	1	0	16
Total Goods	0	4	3	24	7	6	19	63
Services								
A R&D	3	7	8	12	17	7	9	63
B Special studies, not R&D	0	0	0	1	0	1	0	2
D Automatic data processing and telecom services	1	1	4	0	2	0	0	8
J Maintenance and repair	0	6	1	4	2	0	0	13
K Modification of equipment	0	0	1	3	2	0	0	6
L Technical representative services	0	0	0	1	1	1	2	5

Table D.1—Continued

First Character of PSC and Type of Contract Action	Size of Contract Action							Total
	\$0–\$100K	\$100K– \$500K	\$500K– \$1M	\$1M– \$10M	\$10M– \$50M	\$50M– \$100M	> \$100M	
Services (continued)								
M Operation of government- owned facility	0	2	0	2	1	1	0	6
R Support services	1	4	6	22	7	3	0	43
S Utilities and housekeeping	0	0	5	7	3	0	0	15
Other Services	0	5	6	5	1	1	1	19
Total Services	5	25	31	57	36	14	12	180
Total Goods and Services	5	29	34	81	43	20	31	243

Table D.2
Value of Contract Actions in Analysis Sample (\$ millions), by Dollar Size and PSC

First Character of PSC and Type of Contract Action	Size of Contract Action							Total
	\$0–\$100K	\$100K– \$500K	\$500K– \$1M	\$1M– \$10M	\$10M– \$50M	\$50M– \$100M	> \$100M	
Goods								
1 Aircraft and components	0	0	1	52	52	367	8,570	9,042
2 Engines and components	0	0	1	19	36	0	308	364
Other Goods	0	1	1	28	64	61	0	155
Total Goods	0	1	3	99	152	428	8,878	9,561
Services								
A R&D	0	2	6	50	424	424	1,947	2,853
B Special studies, not R&D	0	0	0	4	0	66	0	70
D Automatic data processing and telecom services	0	0	3	0	30	0	0	33
J Maintenance and repair	0	2	1	12	31	0	0	47
K Modification of equipment	0	0	1	6	29	0	0	35
L Technical representative services	0	0	0	2	26	75	389	491

Table D.2—Continued

First Character of PSC and Type of Contract Action	Size of Contract Action						> \$100M	Total
	\$0–\$100K	\$100K– \$500K	\$500K– \$1M	\$1M– \$10M	\$10M– \$50M	\$50M– \$100M		
Services (continued)								
M Operation of government- owned facility	0	1	0	10	21	58	0	91
R Support services	0	1	5	95	167	254	0	522
S Utilities and housekeeping	0	0	4	26	46	0	0	76
Other Services	0	1	4	20	17	54	115	211
Total Services	0	8	23	225	791	931	2,451	4,429
Total Goods and Services	0	9	26	324	943	1,359	10,944	13,584

Extrapolating Survey Findings to All Air Force FY02 DD350 Contract Actions

This appendix describes the statistical approach we used to extrapolate the findings from our survey of contracting officers, who were responsible for the contract actions in our sample, to the entire Air Force FY02 DD350 database. We first divided the sample of contract actions into 14 separate sampling strata made up of two activity-type categories (goods and services), each of which has seven contract-action dollar-amount subcategories.

The seven contract-action dollar-amount subcategories are as follows:

- < \$100,000
- \$100,000–\$500,000
- \$500,000–\$1 million
- \$1 million–\$10 million
- \$10 million–\$50 million
- \$50 million–\$100 million
- > \$100 million.

We then reweighted the sample results for each stratum to match the entire population of Air Force FY02 DD350 actions in one of two ways—depending on whether we were (1) calculating results with respect to contract actions or (2) calculating results with respect to dollars obligated for purchases.

To estimate the proportion of total DD350 contract actions that have a particular characteristic (e.g., the proportion of contract

actions that require multiple PSC codes), we used the following equation:

$$p_w = \sum W_h p_h$$

where

p_h is the proportion of the contract actions sampled in stratum h with the particular characteristic [$h = 1 \dots 14$], and where

W_h is the proportion of all contract actions in the DD350 database that are in stratum h .

Kish (1995) provides the following formula for calculating the variance of estimates calculated in this way:

$$\text{var}(p_w) = \sum W_h^2 (1 - f_h) \frac{p_h(1 - p_h)}{n_h - 1}$$

where

n_h is the sample size in stratum h , and where

f_h is the ratio of sample size to population size in stratum h .

The larger the sample size is relative to the population in each stratum (f_h), the closer the $(1 - f_h)$ term is to zero and the smaller the variance is. Similarly, the further from 50 percent is the proportion of actions with the characteristic of interest in the sample, the smaller the $p_h(1 - p_h)$ term is and the smaller the overall variance estimate is. The variance is then used to calculate the confidence interval.

Table E.1 provides an example of an estimate using this approach. This calculation underlies the result reported in Table 3.5 in Chapter Three—that a single PSC is adequate for 89 percent of contract actions.

Table E.1

Numerical Example of Method Used to Estimate Proportion of Contract Actions with a Particular Characteristic (Percentage of Contract Actions for Which One PSC Is Adequate)

Type/Dollar Size of Contract Action	1. Proportion of Contract Actions in Sample Requiring Only One PSC (p_h)	2. Proportion of Total Population of Contract Actions That Are in Stratum (W_h)	3. Weighted Stratum Contribution to Overall Estimate (Column 1 x Column 2)
Goods/< \$100K	100%	18.7%	18.7%
Goods/\$100K–\$500K	100%	8.4%	8.4%
Goods/\$500K–\$1M	100%	2.0%	2.0%
Goods/\$1M–\$10M	71%	2.9%	2.1%
Goods/\$10M–\$50M	57%	0.3%	0.2%
Goods/\$50M–\$100M	50%	< 0.1%	< 0.1%
Goods/> \$100M	84%	< 0.1%	< 0.1%
Services/< \$100K	80%	35.3%	28.2%
Services/\$100K–\$500K	92%	22.0%	20.2%
Services/\$500K–\$1M	94%	4.9%	4.6%
Services/\$1M–\$10M	86%	5.0%	4.3%
Services/\$10M–\$50M	58%	0.4%	0.2%
Services/\$50M–\$100M	50%	< 0.1%	< 0.1%
Services/> \$100M	67%	< 0.1%	< 0.1%
Sum (p_w)			88.9%

When extrapolating sample *dollar* amounts to the entire DD350 population, we use the combined-ratio estimate of the population share. This estimate is particularly useful when the sample size in a stratum is small, as is the case for contract actions in our smaller-dollar categories. We use the combined-ratio estimate (\hat{Y}_{Rc}) formula from Cochran (1977):

$$\hat{Y}_{Rc} = \frac{\hat{Y}_1}{\hat{X}_1} X$$

where

$$\hat{Y}_1 = \sum_b N_b \bar{y}_b \text{ and } \hat{X}_1 = \sum_b N_b \bar{x}_b$$

An estimate of the amount of expenditures with particular characteristics (e.g., the expenditures on services) is formed by taking the mean of the expenditures for the contract actions in each action/dollar-size stratum (\bar{y}_b) with the particular characteristic and multiplying that mean by the number of actions in the population for each stratum (N_b) to generate an expected total for the population in each stratum. These values are then summed across categories to yield an overall total for expenditures with the desired characteristic (\hat{Y}_1). A similar estimate is calculated using the mean expenditures for the sample for the entire stratum (\bar{x}_b) (with and without the desired characteristic), multiplied again by the number of actions in the population in each stratum (N_b) to yield a total for the entire population when summed across categories (\hat{X}_1). The estimated population total for expenditures with the desired characteristic (\hat{Y}_1) is divided into the estimated population of all expenditures (\hat{X}_1) to arrive at a percentage for the entire population ($(\hat{Y}_{Rc}) / X$). This method allows one to extrapolate, for example, the share of contract dollars in the DD350 population that are used to purchase services.

We calculate confidence intervals for our estimates using the variance formula provided by Cochran (1977):

$$V(\hat{Y}_{Rc}) = \sum_b \frac{N_b^2(1-f_b)}{n_b} (S_{yb}^2 + R^2 S_{xb}^2 - 2R\rho_b S_{yb} S_{xb})$$

where

N_b is the population size in stratum b ,

n_b is the sample size in stratum b ,

f_b is the ratio of sample size to population size in stratum b ,

S_{yh}^2 is the variance of y in stratum h ,

R is the estimated share $(\hat{Y}_{Rc}) / X$,

S_{xh}^2 is the variance of x in stratum h , and

$\rho_h S_{yh} S_{xh}$ is the covariance of x and y in stratum h .

Larger sample sizes relative to the population in each stratum mean that $(1 - f_h)$ in the first term of the variance equation will be closer to zero, reducing the variance of the estimate. Lower variances in the dollar values in the sample with the characteristic of interest and for total expenditures in the sample also lead to tighter confidence intervals.

Table E.2 illustrates the combined-ratio estimate calculation. The table yields the results depicted in Figure 3.8—that spending on services represents 66 percent of total Air Force spending (the sums in the last row of the table are divided to arrive at 66 percent).

Reading across the first row (goods actions for less than \$100,000), columns 1 through 3 are interpreted as follows: Column 1 indicates that there are 12,216 actions in the Air Force FY02 DD350 database that have a PSC beginning with a number (indicating that they are goods actions) and that obligate less than \$100,000 in expenditures. In column 2, for actions in our sample that fall within this category, the average dollar amount that we coded as services is \$50,000. In column 3, for actions in our sample that fall within this category (whether they are services or goods), the average action size is \$50,000. Therefore, all of the goods actions in this category were recoded as services as a result of our discussions with the relevant contracting officers (see Figure 3.3 in Chapter Three).

Table E.2
Numerical Example of Combined Ratio Estimate

Type and Size of Contract Action/	1. Number of Actions in Population (N_h)	2. Mean Dollar Value of Actions in Sample with Characteristic (\$M) ^a (\bar{y}_h)	3. Total Mean Dollar Value of Actions in Sample (\$M) (\bar{x}_h)	4. Estimated Total Expenditures with Characteristic for Population (\$M) (Column 1 x Column 2) ^a (\hat{Y}_1)	5. Estimated Total Expenditures for Population (\$M) (Column 1 x Column 3) (\hat{X}_1)
Goods/< \$100K	12,216	0.05	0.05	583.0	583.0
Goods /\$100K–\$500K	5,477	0.3	0.3	1,573.0	1,573.0
Goods/\$500K–\$1M	1,279	0.5	0.7	625.2	946.0
Goods/\$1M–\$10M	1,923	2.6	5.0	4,990.3	9,692.2
Goods/\$10M–\$50M	225	9.6	21.6	2,158.2	4,860.0
Goods/\$50M–\$100M	24	10.2	71.4	244.8	1,713.6
Goods/> \$100M	21	57.6	469.0	1,209.6	9,849.0
Services/< \$100K	23,095	0.1	0.1	1,346.1	1,346.1
Services/\$100K–\$500K	14,378	0.3	0.3	4,425.3	4,425.3
Services/\$500K–\$1M	3,226	0.8	0.8	2,584.3	2,670.2
Services/\$1M–\$10M	3,296	3.8	4.0	12,554.0	13,110.1
Services/\$10M–\$50M	279	20.4	22.0	5,691.6	6,138.0
Services/\$50M–\$100M	26	38.6	61.9	1,003.6	1,609.4
Services/> \$100M	13	93.0	204.0	1,209.0	2,652.0
Sum				40,198.0	61,167.9

^a The characteristic of interest here is whether the expenditures were for services.

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